ASEE-NASA SUMMER FACULTY INSTITUTE

U OF HOUSTON - MSC - TEXAS A&M PROGRAM

1969 FINAL REPORT

By

Co-Director: C. J. Huang

Co-Director: J. L. Youngblood

Associate Director: W. J. Graff

Sept. 10, 1969

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GENERAL REVIEW

This is the Fifth summer the Houston - MSC - A&M Program of the ASEE-NASA Summer Faculty Institute has been conducted. Briefly, the highlights of the program may be summarized as follows:

1. Faculty Fellows

Again this year, as last year, the initial dissemination of the program announcement was handled by a centralized office in ASEE headquarters. Eighty-seven professors submitted applications before the closing date of Februrary 15, 1969. The number of applications this year was 11 per cent more than that of last year.

The selection of the fellows was made on March 15, 1969, jointly by the co-directors and the associate director. The 1969 applicants are listed in Table 1. Twenty-four applicants were awarded the fellowship, and reported for the program on June 9, 1969. In addition, ten of the last years fellows returned to the program. The names and the home institutions of the thirty-four fellows are shown in Table 2. They came from twenty-nine different schools which are located in eighteen states. As shown in Table 3, 75 per cent of the first year fellows possess Ph.D. degrees. The fellows are relatively young; the average age of the first and second year fellows this year is 35 years. Their teaching experience ranges from one to thirteen years. The following fifteen engineering and science disciplines were represented among the first and second year fellows:

Electrical Engineering	6
Physics	5
Chemical Engineering	3
Chemistry	3
Mathematics	3
Biology	2

Industrial Engineering	2
Mechanical Engineering	2
Metallurgy	2
Civil Engineering	1
Geology	1
Health and Physical Education	1
Physiology	1
Physical Authropology	1
Space Science	1

2. Program Administration

The overall program was conducted by the following induviduals:

C. J. Huang, Co-Director, University of Houston

J. L. Youngblood, Co-Director, NASA-MSC

W. J. Graff, Associate Director, University of Houston

As the University of Houston assumed the fiscal responsibility, the University Co-Director was primarily engaged in administering the funds allocated to this program. The NASA-MSC Co-Director was resonsible for the coordination of research. The Associate Director organized and administered the lecture and seminar series, and assisted the Co-Directors as needed.

In addition, the following members of the University of Houston, NASA-MSC, and Texas A&M have contributed to the success of the program:

Philip G. Hoffman, President
University of Houston

Paul E. Purser, Special Assistant to the Director
NASA Manned Spacecraft Center

C. V. Kirkpatrick, Dean of Engineering
University of Houston

Inez Law, Secretary for the Program
University of Houston

F. J. Benson, Dean of Engineering
Texas A&M University

A. E. Cronk, Advisory Committee Member
Texas A&M University

The ASEE prepared the announcements and was responsible for

related publicity. The Society office also handled the initial inquiry and reply.

3. Lectures and Seminars

To supplement the research activities of the faculty fellows and update their knowledge, special seminars related to aerospace engineering and science were conducted under the direction of Dr. Huang and Dr. Graff at the University of Houston.

All of the participants attended the eight seminars. Six of them were conducted on the University of Houston campus, and the other two were held at the Manned Spacecraft Center. Each seminar lasted for two hours, with ample time for very active discussion and exchange of ideas.

The seminar schedule, topics and speakers are listed in Table 4.

Although Dr. Anthony J. England, Scientist Astronaut, was scheduled to be one of the seminar speakers, his assigned duties relating to the Apollo 11 mission and moon walk prevented his participation. Dr. Willard Libby agreed to take Dr. England's place in the schedule. He repeated his highly acclaimed presentation of last year, "Life on Planet Venus". Without exception, each seminar was excellent and enthusiastically received. The seminars were also well attended by University of Houston faculty and graduate students, NASA technical personnel and local aerospace engineers. Dr. Libby's seminar was thought by many of the participants to be the most outstanding of the whole series. The question and discussion period following his presentation lasted approximately an hour.

In addition, four short courses were offered, which are summarized in Table 5. The hybrid computation facilities of both the Manned Spacecraft Center and the Cullen College of Engineering were available to the attendees of the hybrid computer course. This provided them with the opportunity of practicing what they learned in the classroom. Eleven people signed the attendance sheet on the first day of Dr. D.W.C. Shen's lectures; five of these were MSC employees. The Bio-Medical Engineering lectures were the most popular. Twenty-three people

registered the first day; six were MSC employees. Sixteen people, all faculty fellows, attended the Hybrid Computation lectures. This year Dr. C. F. Chen gave his course on State Modeling and Digital Computing of Control Systems as part of an NSF summer program and a few NASA faculty fellows attended several of the lectures.

Again this year Dr. James Stricklin of Texas A&M University, Department of Aerospace Engineering, offered his lecture series entitled, "Application of Finite Element Techniques to Structural Analysis". The lectures were given at the Manned Spacecraft Center and were attended by two summer faculty fellows and nine NASA technical personnel and NASA-NAS post-doctoral fellows at MSC.

Each first-year fellow thus spent about 40 hours during the 10-week tenure attending the seminars and lectures; and the second-year fellow, 16 hours.

4. Research Activities

The mission of the Manned Spacecraft Center is unique among the NASA centers in that the main efforts are devoted to the achievement of certain design and operational goals of integrated systems. For this reason the faculty fellows had innumerable choices for their research projects, all related to engineering design and operation of manned spacecraft. All of the research assignments were challenging and were within the fields of interest to the participants.

Each summer faculty fellow was assigned to a senior engineer or scientist at MSC who acted as his research advisor. The research topics and research advisors are listed in Table 6, and the research accomplishments by each of the fellows are summarized in Appendix I. The mutual cooperation between a faculty fellow and his research advisor was excellent. Words of appreciation are due to all the NASA research advisors.

It is also noted that in order to complete the assigned projects, eleven faculty fellows were allowed to extend their fellowship tenure slightly. The times varied from a couple of days to two weeks.

EVALUATION AND RECOMMENTATIONS

1. The original objective of providing educators with educational and research opportunities in space engineering was achieved. All the faculty fellows without exception feel that they have increased their competence and interest in space-related fields as a result of participating in the program. Each fellow has recognized that many problems related to space science and engineering can be incorporated into his teaching and research activities. Thus, it is most gratifying to note that the fellows' participation benefits not only the individual in improving his ability, but also his institution in developing its educational and research activities in space-related fields.

2. In general, the fellows were well prepared for their respective research assignments at the Manned Spacecraft Center. Based on the evaluations of the research advisors, all of the faculty fellows contributed effectively to the development and research activities at the Manned Spacecraft Center. Their cooperativeness, diligence and interest were excellent. The Manned Spacecraft Center benefited from the program: (a) as evidenced by the fact that the research advisors have indicated that they are willing to serve again in similar capacities next year, and (b) in that at least twenty MSC employees participated in the four lecture series offerred for the faculty fellows. According to first day attendance records five MSC people attended

Dr. David Shen's lectures, six attended Dr. George Bugliarello and Associates' classes, and nine took Dr. James Stricklin's short course.

3. In general, the faculty fellows agreed that the present division of the fellows' time between research and seminars is reasonable and desirable. However, the majority of the NASA supervisors favored the reduction of lecture hours and wished that the faculty fellows could spend more time for research and development tasks. The co-directors believe that the present ratio of research to lecture time is adequate to maintain a proper balance between educational and research participation of the faculty fellows.

The duration of the program may be increased from ten to twelve weeks in the future to provide additional time for research and development activities. Nine fellows asked for and received a one week extension of their time. Two additional fellows were permitted to extend their time by two weeks.

4. Most of the fellows believed that the stipend is fairly adequate. Several of the fellows, however, felt that an effort should be made to match their regular salary. Each faculty member has a financial sacrifice in the range of $500 to $1750 to participate in this program.

5. Before the program began, several faculty fellows communicated with their prospective NASA research advisors for selection of research and development assignments. This was very beneficial.

The majority of the fellows determined their research project assignments through discussion with their MSC advisors during the first couple of days of the 10 week period. This worked out reasonably well in the selection of desirable projects for this year.

6. The NASA Manned Spacecraft Center possesses many interesting and advanced research and development facilities. The faculty fellows are very eager to visit and see these installations. Therefore, the extensive and technically oriented tours of the Manned Spacecraft Center facilities were very well received by the fellows.

7. At the conclusion of the program, a one-day meeting was held at which each faculty fellow made an oral presentation of the results of his summer project. This oral presentation was attended by all the fellows, and many NASA technical staff. An active discussion took place after each presentation. It was also a very useful means for information exchange between NASA employees and the faculty fellows.

8. In addition to their R & D activities at NASA-MSC, the faculty fellows indicated enjoyment of the seminars conducted at the University. These were challenging and worthwhile. All eight seminars this year were related to a central theme "Identifying Earth Resources by Remote Sensing." The fellows remarked generally in their questionnaires at the end of the program that there was too much overlapping among the seminar

speakers albeit each was interesting and stimulating. A different plan will be used for the seminars next year.

9. The shortage of the office space at MSC requires the sharing of an office by a few faculty fellows. An effort will be made for a better arrangement next summer. The social activities, including a boat trip along the Houston ship channel, the "Welcome Home" Astrodome program for the Apollo 11 astronauts, the downtown parade for them, and several family picnics were enjoyed by the faculty fellows and in turn provided better opportunities for the fellows and the staff to become acquainted with each other. The benefits of contacts among the summer faculty fellows provided many opportunities for the exchange of ideas and technical discussion.

10. Concurrently with the research summer faculty fellowship program, a NASA-ASEE Engineering System Design Summer Faculty Fellowship Program was conducted in Houston. The latter provides the research fellows with an opportunity of observing the design activities and again serves as an additional professional association.

TABLE 1

1969 APPLICANTS

Adams, T. G.	Lawrence Institute of Technology
Allen, J. R.	Clemson University
Amer, S. H.	Chico State College
Bennett, G. K.	Texas Technological College
Black, W. Z.	Georgia Institute of Technology
Bluman, D. E.	Bucknell University
Breitmeyer, M. O.	Rose Polytechnic Institute
Bohannon, T. R.	Tarleton State College
Burden, S. L.	Taylor University
Butler, J. C.	University of Houston
Cable, J. D.	University of California, Los Angeles
Calton, W. G.	Eastern New Mexico University
Carman, J. H.	University of Iowa
Chang, C. C.	Oregon State University
Chia, R. C.	University of Houston
Cranson, K. R.	Lansing Community College
Cummings, W. D.	University of California, Los Angeles
Dareing, D. W.	University of Arkansas
Deufel, R. D.	Indiana Central College
Douglas, R. L.	Mississippi State University
Duncan, W. P.	Panhandle State College
Dunham, C. E.	Clarkson College of Technology
Everett, A. G.	Ohio State University
Feiste, V. K.	Southern Illinois University
Forsythe, R. K.	Broome Technical Community College
Gesinski, R. M.	Kentucky State University
Glen, T. M.	University of Toledo
Graham, R. R.	Texas Technological College
Griffiths, V.	Montana Technological College
Gunter, B. D.	Southwestern State College of Oklahoma
Harris, F. W.	Kansas State University

1969 Applicants -- Page 2.

Harrison, F. R.	University of Maine
Hasdorff, L.	Virginia Polytechnic Institute
Haynie, R. M.	Kansas State University
Healey, H. M.	Purdue University
Herring, L. H.	Fairmont State College
Huang, C. R.	Newark College of Engineering
Huntsinger, R. C.	South Dakota School of Mines and Technology
Johnson, D. B.	Southern Methodist University
Johnston, A. S.	Pratt Institute
Jones, F. A.	Eastern Oklahoma College
Jones, P. K.	Southwestern State College of Oklahoma
Kimzey, J. R.	University of Arkansas
Krasner, S.	U.S. Coast Guard Academy
Krile, T. J.	Rose Polytechnic Institute
Landman, D. A.	New York University
Larson, R. D.	Illinois Institute of Technology
Lasker, S. E.	New York Mecical College
Lazzari, E. P.	University of Texas - Dental Branch
Lingelbach, D. D.	Oklahoma State University
Little, M. A.	Ohio State University
Liu, C. K	University of Alabama
Lucas, J. E.	Iowa State University
Luckinbill, D. L.	Tennessee Technical University
Malindzak, G. S.	Bowman Gray School of Medicine
Martin, N. F.	Saint Louis University
Matlock, R. L.	Louisiana State University at Shreveport
McConville, J. T.	Antioch College
McCoy, L. E.	Glendale Community College
McCoy, W. B.	University of Saskatchewan
McLeroy, D. F.	Lehigh University
Michael, E. D.	University of California
Minshew, V. H.	University of Mississippi

1969 Applicants -- Page 3.

Mix, D. F.	University of Arkansas
Murad, F. M.	Fairleigh Dickinson University
Newman, A. K.	Moore School of Electrical Engineering
Osburg, H. E.	State University College of New York
Pettit, L. A.	University of Utah
Pollard, C. O.	Georgia Institute of Technology
Powell, C. R.	Portand State College
Rikoski, R. A.	University of Pennsylvania
Russell, J. R. III	Athens College
Schultz, J. H.	University of Massachusetts
Sebesta, H. R.	Oklahoma State University
Shimondle, S. L.	Holy Family Academy
Song. Y. T.	University of Tennessee
Spence, D. W.	Baylor University College of Medicine
Stanziale, W. G.	Saint Joseph College
Welsch, F.	Dartmouth Medical School
Whalen, F. D.	Allegheny Community College
Wheeler, L. T.	University of Houston
Williamson, W., Jr.	University of Toledo
Winnick, J.	University of Missouri
Wolf, P. R.	University of California
Wong, K. W.	University of Illinois
Yu, D. U. L.	Seattle Pacific College
Zeimer, R. E.	University of Missouri

TABLE 2

1969 FIRST YEAR RESEARCH FELLOWS

Dr. Joe F. Allen
Department of Chemistry & Geology
Clemson University
Clemson, South Carolina 29631

Dr. Saad H. Amer
Department of Electrical Engineering
Chico State College
Chico, California 95926

Prof. G. Kemble Bennett
Computing Center
Texas Technological College
Lubbock, Texas 79409

Dr. William Z. Black
Department of Mechanical Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Dr. Michael O. Breitmeyer
Department of Biological Engineering
Rose Polytechnic Institute
Terre Haute, Indiana 47803

Dr. Stanley L. Burden
Department of Chemistry
Taylor University
Upland, Indiana 46989

Dr. John C. Butler
Geology Department
University of Houston
Houston, Texas 77004

Dr. W. David Cummings
Department of Planetary & Space Science
University of California, Los Angeles
Los Angeles, California 90024

Dr. Vernold K. Feiste
School of Technology
Southern Illinois University
Carbondale, Illinois 62901

Prof. Robert K. Forsythe
Department of Mathematics & Physics
Broome Technical Community College
Binghamton, New York 13902

1969 FIRST YEAR RESEARCH FELLOWS - Page 2

Dr. Thaddeus M. Glen
Department of Industrial Engineering
University of Toledo
Toledo, Ohio 43606

Mr. Roy R. Graham
Department of Chemical Engineering
Texas Technological College
Lubbock, Texas 79409

Dr. Vernon Griffiths
Department of Metallurgy
Montana College of Mineral Science & Technology
Butte, Montana 59701

Dr. Donald A. Landman
Department of Physics
New York University
Bronx, New York 10453

Dr. Michael A. Little
Department of Anthropology
The Ohio State University
Columbus, Ohio 43210

Dr. Dennis L. Luckinbill
Department of Mechanical Engineering
Tennessee Technological University
Cookeville, Tennessee 38501

Dr. Rex L. Matlock
Chemistry & Physics Department
Louisiana State University
Shreveport, Louisiana 71105

Mr. Leslie E. McCoy
Department of Electronics
Glendale Community College
Glendale, Arizona 85301

Dr. Dwight F. Mix
Department of Electrical Engineering
University of Arkansas
Fayetteville, Arkansas 72701

Prof. Frank M. Murad
Department of Mechanical Engineering
Fairleigh Dickinson University
Teaneck, New Jersey 07661

Prof. John R. Russell, III
Department of Biology
Athens College
Athens, Alabama 35611

Dr. Dale W. Spence
Department of Pediatrics
Baylor University College of Medicine
Texas Medical Center
Houston, Texas 77025

Dr. William G. Stanziale
Department of Biology
St. Joseph College
West Hartford, Connecticut 06117

Dr. William Williamson, Jr.
Department of Physics
University of Toledo
Toledo, Ohio 43606

TABLE 2-A

1969 SECOND YEAR RESEARCH FELLOWS

Prof. Carl W. Bechtold
Engineering Center
University of Colorado
Boulder, Colorado 80302

Prof. Hugh J. Costello
Physical Science Department
U.S. Coast Guard Academy
New London, Connecticut 06320

Dr. Edward H. Crum
Department of Chemical Engineering
West Virginia Insitute of Technology
Montgomery, West Virginia 25136

Dr. Ernest A. Franke
Department of Electrical Engineering
Texas A & I University
Kingsville, Texas 78363

Dr. Joseph B. Frechen
Mathematics Department
St. John's University
Jamaica, New York 11432

Dr. William G. Henderson
Department of Civil Engineering
The University of Texas, El Paso
El Paso, Texas 79999

Prof. Dale F. Oexmann
Mathematics Department
Rose Polytechnic Institute
Terre Haute, Indiana 47803

Dr. Walter R. Roser
Metallurgical Engineering Department
The University of Texas, El Paso
El Paso, Texas 79999

Prof. James E. Sees
Department of Electrical Engineering
University of South Carolina
Columbia, South Carolina 29208

Dr. Bert Wilkins, Jr.
Department of Chemical Engineering
Louisiana State University
Baton Rouge,Louisiana 70803

TABLE 3

BACKGROUND OF FIRST YEAR FACULTY FELLOWS

Name	Age	Degree and Year	Academic Rank	Major	Teaching Experience Years
Allen	34	Ph.D.1963	Assoc.Prof.	Chemistry	5
Amer	46	Ph.D.1949	Professor	E.E.	13
Bennett	29	M.S. 1968	Instructor	Mathematics	3
Black	28	Ph.D.1968	Assist.Prof.	M.E.	7
Breitmeyer	28	Ph.D.1968	Assist.Prof.	Physiology	3
Burden	30	Ph.D.1966	Assist.Prof.	Electro-Chemistry	7
Butler	27	Ph.D.1968	Assist.Prof.	Geology	2
Cummings	28	Ph.D.1966	Assist.Prof.	Space Science	5
Feiste	33	Ph.D.1966	Assist.Prof.	E.E.	6
Forsythe	27	M.S. 1968	Assist.Prof.	Physics	4
Glen	42	Ph.D.1965	Professor	I.E.	6
Graham	27	M.S. 1967	Instructor	Ch.E.	3
Griffiths	40	Sc.D.1955	Professor	Physical Metallurgy	11
Landman	30	Ph.D.1965	Assist.Prof.	Physics	3
Little	32	Ph.D.1968	Assist.Prof.	Physical Anthropology	5
Luckinbill	27	Ph.D.1968	Assist.Prof.	M.E.	3
Matlock	34	Ph.D.1967	Assist.Prof.	Physics	5
McCoy	40	M.S. 1959	Professor	E.E.	5
Mix	37	Ph.D.1965	Assist.Prof.	E.E.	10
Murad	45	M.S. 1968	Assoc.Prof.	I.E.	10
Russell	27	M.S. 1966	Assist.Prof.	Zoology	2
Spence	35	Ph.D.1966	Assist.Prof.	Health & Physical Ed.	5
Stanziale	43	Ph.D.1960	Assoc. Prof.	Micro-biology	8
Williamson	35	Ph.D.1963	Assist.Prof.	Physics	5

TABLE 3-A

BACKGROUND OF SECOND YEAR FACULTY FELLOWS

Name	Age	Degree and Year	Academic Rank	Major	Teaching Experience Years
Bechtold	52	B.S. 1938	Sr. Instructor	I.E.	8
Costello	33	M.S. 1963	Asst. Prof.	Chemistry	11
Crum	28	Ph.D.1967	Asst. Prof.	Ch.E.	3
Franke	29	Ph.D.1967	Assoc. Prof.	E.E.	2
Frechen	45	Ph.D.1967	Asst. Prof.	Math	9
Henderson	50	Ph.D.1966	Professor	C.E.	13
Oexmann	29	M.S. 1963	Asst. Prof.	Math	4
Roser	37	Ph.D.1967	Assoc. Prof.	Metallurgy & Physics	3
Sees	56	M.S. 1939	Assoc. Prof.	Physics	13
Wilkins	34	Ph.D.1965	Asst. Prof.	Ch.E.	5

TABLE 4

1969 ASEE-NASA
SUMMER FACULTY INSTITUTES

University of Houston
NASA Manned Spacecraft Center
Texas A&M University
Rice University

SPECIAL SEMINAR ON AEROSPACE ENGINEERING AND SCIENCE

Sponsors:

National Aeronautics & Space Administration
American Society for Engineering Education

For information please call

Dr. C. J. Huang
University of Houston
RI 8-6600, Ext. 408

Dr. J. L. Youngblood
NASA Manned Spacecraft Center
HU 3-2665

PLACE & TIME

Place: Room 102, New Engineering Building (D)
(Except for June 30 and July 30)
University of Houston

Time: 9:00-11:00 a.m.

Theme: Identifying Earth Resources by Remote Sensing

SEMINAR SCHEDULE

Monday, June 23
Dr. William Marlatt
Dept. of Atmospheric Sciences
Colorado State University

"Introduction to Remote Sensing and Application to Air Pollution"

Wednesday, June 25
Dr. J. Ralph Shay
Department of Plant Pathology
Oregon State University
Corvallis, Oregon

"Potential Development of Remote Sensing Systems Over the Next Decade and Application to Agriculture and Forestry"

Monday, June 30
*Dr. R. K. Moore
Research Center in Engineering Sciences
University of Kansas

"Use of Space-borne Radar for Studying the Earth's Environment and Resources"

Wednesday, July 2
Dr. Bruce Lusignan
Stanford University
Palo Alto, California

"An Earth Resources Satellite Study as an Example of Systems Design Engineering"

Wednesday, July 23
Mr. Donald S. Ross
Photographic Research Engineer
Philco-Ford Corporation
Palo Alto, California

"Specialized Photography for Studying the Earth's Environment and Resources"

Wednesday, July 30
*Mr. William Fischer
Earth Resources Satellite Program
U.S. Geological Survey
Washington, D. C.

"Satellites for Studying the Earth's Resources and Atmosphere"

Tuesday, August 5
Dr. Anthony R. Barringer
Barringer Research, Ltd.
Rexdale, Ontario, Canada

"Remote Sensing for Mineral Discovery"

Thursday, August 7
Dr. Anthony J. England
Scientist Astronaut
Manned Spacecraft Center

"Application of Long Wavelength Electromagnetic Radiation to Geology"

*Auditorium, Building 30, Manned Spacecraft Center
Call HU 3-7311 for directions.

TABLE 5

LECTURE A

ADAPTIVE AND LEARNING TECHNIQUES

IN

ENGINEERING CYBERNETIC SYSTEMS

TOPICS:

1. Optimum Stationary and Nonstationary Linear Systems.
2. A Class of Optimum Nonlinear Filters.
3. Self-Optimizing Nonlinear Filters.
4. Kalman Filter and Estimator.
5. Real-time Control of Linear-time Varying Dynamic Systems.
6. Stochastic Approximation Techniques and Their Application to System Parameter Identification.
7. Learning Algorithms using Reinforcement Techniques.
8. Bayes Procedure to Statistical Decision Theory.
9. Sequential Bayes Estimation and its Application to Parameter Identification: Relation to Kalman Estimator.
10. Empirical Bayes Approach to Adaptive Control.

June 30 - July 3
Dr. David W. C. Shen
Professor of Electrical Engineering
University of Pennsylvania
Philadelphia, Pennsylvania
9:00 - 12:00 a.m. Lecture
1:30 - 4:30 p.m. Lecture and Laboratory

LECTURE B

BIOMEDICAL ENGINEERING

TOPICS:

Dr. Bugliarello

1. Introduction to Biomedical Engineering
2. Principles of Physiological Systems Analysis
3. Biological Flows
4. Health Systems

Dr. Troelstra

1. Mechanics of the Eye
2. Retina Diagrams
3. Central Nervous Systems

Dr. Gose

1. Pattern Recognition
2. Biocommunication
3. Response Mechanisms

July 7 - 11
Dr. George Bugliarello
Chairman of Bio-Technology Program
Carnegie-Mellon Univ., Pittsburgh, Penn.
9:00 - 11:00 a.m. Lecture
1:30 - 3:30 p.m. Lecture
Dr. Arne Troelstra and Dr. Earl Gose
Assoc. Professors of Bio-Engineering at the Chicago Campus
of the University of Illinois

LECTURE C

HYBRID COMPUTATION

TOPICS:

1. Review of Analog and Digital Programming Concepts with Special Emphasis on Hybrid Requirements. The Scope of Hybrid Computation

2. System Specifications Matching Performance Criteria with Area of Application

3. Analog-to-Digital and Digital-to-Analog Interfacing

4. Simple Applications of Hybrid Computers, Patchable Logic and Iterative Computation

5. Error Analysis Techniques, Sampling Errors, Static and Dynamic Errors

6. Design and Use of Hybrid Software, Executive Routines, Recursive Routines, Trap Processing

7. Digital Simulation Software

8. Simulation of Sampled Data Systems and Random Processes

9. Numerical Integration by Hybrid Techniques

10. Maintenance, Diagnostic and Other Programming Aids

11. Optimization Theory and Applications to Multiparameter Systems, Trajectory Optimization, Guidance and Control, Mission Design and Analysis

12. Partial Differential Equations

13. Error Compensation Methods

14. Management of Hybrid Facilities

July 14 - 18
Dr. R. L. Motard, Chemical Engr. Dept.
Dr. G. F. Paskusz, Electrical Engr. Dept.
University of Houston
9:00 - 10:15 a.m. Lecture
1:00 - 5:00 p.m. Laboratory

LECTURE D

APPLICATION OF FINITE ELEMENT TECHNIQUES

TO

STRUCTURAL ANAYLSIS

This course will cover finite element techniques as applied to stress analysis in beams, plates, plane stress and plane strain, bodies and shells of revolution; and as applied to thermal conduction and fluid dynamics.

TOPICS:

1. Structural Stiffness Analysis
   The Structural Element
   Assembly and Analysis of a Structure
   Transformation of Coordinates

2. Finite Elements of a Continuum
   Specific Elements (ring, triangle, rectangle, etc.)
   Global and Local Coordinates
   Formulation of Element Characteristics
   Interelement Compatibility and Equilibrium
   Monotonic Convergence

3. Application of Finite Elements in Structural Analysis
   Structural Stiffness and the Tridiagonal Matrix
   The Connection Matrix and the Assembly of the Element Stiffness
   Loads (mechanical, thermal, settlement, etc.)

4. Programmable Automatic Checks
   Overall Equilibrium
   Maxwell-Betti Reciprocity
   Closed Form Classical Solution
   Empirical Data Checks

August 4 - 8
Dr. James A. Stricklin
Prof. of Aerospace Engr.
Texas A&M University
1:00 - 5:00 p.m.

AVAILABLE ADDITIONAL PROGRAM

STATE MODELING AND DIGITAL COMPUTING OF CONTROL SYSTEMS

LECTURE TOPICS:

MON:
1. State Space Modeling I
   Bush's Form, Guillemin's Form, Foster's Form, Cauer's Form, etc.
2. State Space Modeling II
   Lagrange's Formulation, Hamilton's Formulation, Legendre's Transformation, etc.

TUES:
3. Solution Techniques I
   Gauss Elimination, Similarity Transformation and Digital Computer Programs for Matrix Inversion
4. Solution Techniques II
   Runge-Kutta Method and its Digital Computer Program

WED:
5. Solution Techniques III
   General Inversion Problem, General Phase Space Formula and its Digital Computer Program
6. Stability Studies I
   Liapunov's 2nd Method, Construction of Liapunov Functions, Computer Program

THURS.
7. Stability Studies II
   Describing Function in Hate Space Formulation, Fovier Transform Computer Programming
8. Model Simplification Methods
   Irrational Transfer Function Approximation, Model Reduction, and Computer Programs

FRI:
9. Identification Problem
   Time Domain and Frequency Domain Identification, Levy's Technique and its Computer Program
10. Design and Optimization
   Performance Index Calculations, Introduction to Dynamic Programming

July 7 - 11

Dr. C. F. Chen, University of Houston
Professor of Electrical Engineering
Office: Rm N318D of Engineering Building
Phone Ext. 514

Contact Dr. Chen for exact time of lectures

TABLE 6

RESEARCH TOPIC, SPONSOR AND DIVISION

Dr. Joe F. Allen
Topic: Sodium and Potassium Distribution in Cells by Isotropic Tracers and Electron Microprobe Studies
Sponsor: Dr. Carter W. Alexander
Division: Preventive Medicine Office

Dr. Saad H. Amer
Topic: Space Base Rotary Interface and Brayton Cycle Unit Startup
Sponsor: Mr. Forrest E. Eastman
Division: Space Electronics Systems

Prof. Carl W. Bechtold
Topic: A Computer Graphics System
Sponsor: Dr. Monte D. Cunningham
Division: Computation and Analysis

Mr. G. Kemble Bennett
Topic: An Empirical Bayes Estimator for the Shape Parameter in a Weibull Distribution
Sponsor: Dr. Jay M. Lewallen
Division: Computation and Analysis

Dr. William Z. Black
Topic: An Analysis of the Heat Rejection Characteristics of Tapered Radiating Fins
Sponsor: Mr. William E. Simon
Division: Propulsion and Power

Dr. Michael O. Breitmeyer
Topic: Microscopic Holography
Sponsor: Dr. Carter W. Alexander
Division: Preventive Medicine Office

Dr. Stanley L. Burden
Topic: Water Electrolysis Units for Use in a Space Base
Sponsor: Dr. David Bell III
Division: Propulsion and Power

Dr. John C. Butler
Topic: Unit Cell Refinement of Cryptoperthites
Sponsor: Mr. Elbert King
Division: Lunar and Earth Sciences

Prof. Hugh J. Costello
Topic: Uranium Disequilibrium in Geochronology
Sponsor: Dr. Ted H. Foss
Division: Lunar and Earth Sciences

Dr. Edward R. Crum
Topic: Systems for the Production and Storage of Chemicals for Spacecraft Atmospheric Gas Supply
Sponsor: Dr. Noel C. Willis, Jr.
Division: Crew Systems

Dr. Warren D. Cummings
Topic: Simultaneous Observations of Micropulsations at Fort Yukon, Alaska, and the ATS-1
Sponsor: Mr. John O. Annexstad
Division: Lunar and Earth Sciences

Dr. Vernold K. Feiste
Topic: Conceptual Design of a Space Base Power System
Sponsor: Dr. David Bell III
Division: Propulsion and Power

Prof. Robert K. Forsythe
Topic: Some Experimental and Theoretical Aspects of the Sabatier Methanation Reaction
Sponsor: Dr. Noel C. Willis, Jr.
Division: Crew Systems

Dr. Ernest E. Franke
Topic: A computer-Aided Logic Design System
Sponsor: Mr. Oscar Patterson
Division: Information Systems

Dr. Joseph B. Frechen
Topic: Graph Connectivity Algorithms
Sponsor: Dr. Jay M. Lewallen
Division: Computation and Analysis

Dr. Thaddeus M. Glen
Topic: Lunar and Space Habitability Requirements
Sponsor: Mr. Allen J. Louviere
Mr. Earle V. Lafevers
Division: Advanced Spacecraft Technology

Prof. Roy R. Graham
Topic: Catalytic Oxidation of Trace Atmospheric Contaminants
Sponsor: Dr. Noel C. Willis, Jr.
Division: Crew Systems

Dr. Vernon Griffits
Topic: Transmission Electron Microscopy Studies
Sponsor: Mr. R. L. Johnston
Division: Structures and Mechanics

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Dr. W. G. Henderson
Topic: Feasibility of a Pneumatic Impact System to Test the Sensitivity of Nonmetallic Materials
Sponsor: Mr. K. B. Gilbreath
Division: White Sands Testing Facility

Dr. Donald A. Landman
Topic: Some Applications of IR Interference Spectroscopy
Sponsor: Dr. Andrew E. Potter
Division: Space Physics

Dr. Michael A. Little
Topic: Circadian Variation and Heat Stress
Sponsor: Dr. John A. Rummel
Division: Biomedical Research Office

Dr. Dennis L. Luckinbill
Topic: Computer Control of the Acoustic Testing Facility
Sponsor: Mr. Allan D. Gist
Division: Structures and Mechanics

Dr. Rex L. Matlock
Topic: A Theoretical Calculation of the Energy Absorbed by the Nuclear Cascade Process in an Ionization Calorimeter
Sponsor: Dr. Richard J. Kurz
Division: Space Physics

Prof. Leslie E. McCoy
Topic: Comparision of Display Devices for Computer Input and Output
Sponsor: Mr. John W. O'Neill
Division: Flight Crew Support

Dr. Dwight F. Mix
Topic: PCM--PSK Versus FM for Color TV Transmission for Space Base Applications
Sponsor: Dr. George D. Arndt
Division: Information Systems

Prof. Frank M. Murad
Topic: Interactive Graphics Study in Support of Computerized Flight Planning System
Sponsor: Mr. John W. O'Neill
Division: Flight Crew Support

Prof. Dale F. Oexmann
Topic: Optimal Orbit Transfer with Finite Thrust
Sponsor: Mr. D. J. Jezewski
Division: Mission Planning and Analysis

Dr. Walter Roser
Topic: Combination of Materials Compatability with Aerozine-50 Fuel
Sponsor: Mr. L. M. Clelland
Division: White Sands Testing Facility

Prof. John R. Russell
Topic: Baseline Techniques for Obtaining a Germ-Free Oviparous Fish Using Fundulus Heteroclitus
Sponsor: Dr. Richard A. Boster
Division: Preventive Medicine Office

Prof. James E. Sees
Topic: Radome Effects upon Antenna Temperature in a Remote Sensing Microwave Radiometer
Sponsor: Mr. Douglas S. Lilly
Division: Space Electronic Systems

Dr. Dale W. Spence
Topic: Comparision of Two Exercise Capacity Tests
Sponsor: Dr. William R. Carpentier
Division: Preventive Medicine Office

Dr. William C. Stanziale
Topic: A Descriptive Analysis of the Bacterial Flora Recovered from the Skin of the Apollo Astronauts.
Sponsor: Dr. Kelton J. Ferguson
Division: Preventive Medicine Office

Dr. Bert Wilkings, Jr.
Topic: Fluid Particle Flows in Biological Systems
Sponsor: Dr. Craig L. Fischer
Division: Preventive Medicine Office

Dr. William Williamson, Jr.
Topic: Electron Excitation of Atoms
Sponsor: Dr. Robert P. Kovar
Division: Space Physics

APPENDIX I

Reports on Research Activities

Copies are available at the following locations:

NASA Headquarters, Washington, D. C.
ASEE Headquarters, Washington, D. C.
Manned Spacecraft Center, Houston, Texas
University of Houston, Houston, Texas

Copies will also be available during the ASEE Space Engineering Committee Meeting, October 5-7, 1969.

UNIVERSITY OF HOUSTON
CULLEN COLLEGE OF ENGINEERING
HOUSTON, TEXAS 77004

OFFICE OF THE DEAN

December 10, 1968

Dear Sir:

Under the sponsorship of National Aeronautics and Space Administration and American Society for Engineering Education, two Summer Faculty Institutes were conducted by University of Houston last summer with the cooperation of Rice University, Texas A & M University, and NASA Manned Spacecraft Center.

There were 33 professors of engineering or science selected for the Aeronautics and Space research program. During their stay in Houston for 10 weeks, the faculty fellows participated in a wide range of interesting research and development activities of NASA as well as the seminar and lecture series conducted by distinquished scientists and engineers.

The second program, emphasizing engineering system design activities, completed the design project of Space Service Vehicle (SSV). The team of 19 faculty members consisting of eight disciplines worked together for 11 weeks in Houston. I thought you might be interested in seeing the attached final report which describes the project and its results. I will appreciate receiving any comments and suggestions from you or your colleagues.

Two similar programs will be conducted next summer. We look forward to hearing from you if you wish to nominate any of your faculty members to participate in the program. The announcement describing the features of the programs is enclosed.

Sincerely yours,

C. J. Huang

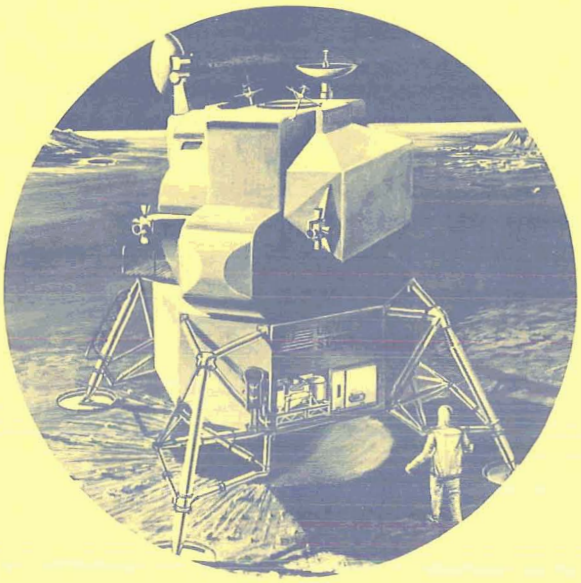
C. J. Huang
Associate Dean

CJH:ci
Encl.

NASA-ASEE

1969 SUMMER FACULTY FELLOWSHIPS

Engineering Systems Design and Research



"The aeronautical and space activities of the United States shall be conducted so as to contribute . . . to the expansion of human knowledge of phenomena in the atmosphere and space."
NATIONAL AERONAUTICS AND SPACE ACT OF 1958

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMERICAN SOCIETY FOR ENGINEERING EDUCATION

NASA-ASEE 1969 Summer Faculty Fellowship Programs

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1 University of Houston and Rice University—NASA Manned Spacecraft Center
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4 Old Dominion College—NASA Langley Research Center

AERONAUTICS AND SPACE RESEARCH INSTITUTES

5 Stanford University—NASA Ames Research Center
7 The Catholic University of America and University of Maryland—NASA Goddard Space Flight Center
8 Case Western Reserve University—NASA Lewis Research Center
10 Old Dominion College—NASA Langley Research Center
11 University of Houston and Texas A&M University—NASA Manned Spacecraft Center
13 University of Alabama and Auburn University—NASA Marshall Space Flight Center
14 California Institute of Technology—NASA Jet Propulsion Laboratory
15 Northeastern University—NASA Electronics Research Center

DEADLINE

for receipt of application and supporting material is

FEBRUARY 15, 1969

Fellows will be notified approximately March 15, 1969

HOST INSTITUTION

UNIVERSITY OF HOUSTON

HOUSTON, TEXAS

HOST INSTITUTION

RICE UNIVERSITY

HOUSTON, TEXAS

NASA CENTER

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

ENGINEERING SYSTEMS DESIGN

11 weeks, 9 June–22 August 1969

GENERAL OBJECTIVES

Design Fellowships will be awarded to engineering and science faculty members to participate, as members of multidisciplinary design teams, in the ongoing activities of the space program with the attendant confrontation with the most modern systems design problems. The engineering systems concept, that of approaching the design problem in its entirety rather than from the initially unconnected viewpoint of many single disciplines, will be utilized by design teams.

Principal objective of the program is to allow the participating Fellows to increase their competence and to develop concepts that will enable them to organize multidisciplinary engineering systems design courses at their home institutions. Such system design concepts have proved to be highly effective in stimulating student innovation and in teaching the application of engineering theories to actual engineering problems. Also, the program will promote the establishment of communication between engineers and scientists in different specialties and help illustrate the importance of such communication; aid in teaching methods of parametric evaluation of complex system alternates; and introduce the students to the potentialities and challenges of the United States' space program.

DESIGN PROJECT

The objective of the Houston-Rice-Manned Spacecraft Center program is to design a vehicle related to the manned space exploration program. The system must satisfy a given set of mission objectives and will be, in general, a configuration of several subsystems such as communication, environmental control, crew system, stabilization and guidance, display and control, structure and heat shields, power and propulsion, and re-entry and landing. The systems should be relatively simple, lightweight, and reliable. They must be stable and require simple control and guidance. The systems should be capable of safe re-entry and landing. Design teams will be established with membership from several scientific and engineering disciplines, i.e., aerospace, mechanical, electrical, chemical, structural, control and industrial engineering, and physics and biology.

The Systems Design project for 1969 will be an advanced lunar exploration system to land and support man and equipment on the moon and provide for a safe return to earth using modified Apollo hardware where applicable. The principal goal of this effort will be to provide a greatly increased astronaut exploration time in man-days on the moon. This will be done with minimum cost and leadtime as the primary objectives.

Operational deviations from the present Apollo design that show promise will be considered. Some of these are direct and indirect lunar landings, direct and indirect launches for earth landing, and the use of various lunar and earth parking orbits for launch platforms.

Appropriate technical experts from the University of Houston, Rice University, NASA-MSC, and other schools and industrial organizations will conduct seminars on subjects related to the chosen system design. Field trips will be arranged to NASA-MSC and related facilities.

APPLICANTS

Applicants should be instructors, professors, or research staff members of colleges or universities, preferably with two or more years of teaching experience. Preference will be given to faculty who apply as a team representing at least two different areas of engineering or science from the same institution, and whose administration is interested in enhancing the application of systems design at their university after the completion of the fellowship program.

GENERAL INFORMATION

As the nation's sixth largest city and third largest port, Houston is renowned for its educational and scientific facilities, which include University of Houston, Rice University, NASA Manned Spacecraft Center, the Texas Medical Center, and many other industrial research organizations.

Houston boasts four major theatres and a number of suburban amateur theatres. Year-round professional entertainment is offered, featuring top names in show business. The Houston Symphony Orchestra is one of the nation's outstanding musical groups. During regular season, the 90-piece orchestra performs in Jones Hall for the Performing Arts under the direction of Andre Previn, and during the summer the group plays in the open-air Miller Theatre. The Houston Museum of Fine Arts exhibit of paintings and other art forms, a $6 million collection, is composed of distinguished works from almost every notable era. Spectacular celestial shows at Houston's new Burke Baker Planetarium transport viewers to other planets in the solar system in a matter of seconds and reveal the heavens as seen from outer space. It is a part of the Houston Museum of Natural Science, located at the edge of beautiful wooded Hermann Park. Hermann Park is the setting for Houston Zoological Gardens, where there are more than 2,000 animals displayed in modern buildings and outdoor exhibits, and an aviary where more than 200 exotic birds are shown.

Sports abound in Houston and the visitor can find almost any kind of recreation he desires. There are four excellent municipal golf courses. Memorial Park is the site of fine facilities for swimming, riding, and tennis. The Astrodome, the world's first air-conditioned all weather stadium, is the scene of numerous headliner events such as National League baseball, Cougar Football, bullfights, polo, circuses, and many others.

Houston undoubtedly has more air conditioning than any other city in the United States; not only hotels, stores, and office buildings, but also public schools, apartments, homes, and autos are air conditioned.

Send request for further information and/or application form to:

Dr. C. J. Huang, Associate Dean
Cullen College of Engineering
University of Houston
Houston, Texas 77004
Telephone: 713-748-6600, Ext. 408

HOST INSTITUTION

AUBURN UNIVERSITY

AUBURN, ALA.

HOST INSTITUTION

THE UNIVERSITY OF ALABAMA

UNIVERSITY, ALA.

NASA CENTER

MARSHALL SPACE FLIGHT CENTER

HUNTSVILLE, ALA.

ENGINEERING SYSTEMS DESIGN

11 weeks, 9 June–22 August 1969

PROGRAM DESCRIPTION

Auburn University, University of Alabama, and Marshall Space Flight Center will conduct one of four Engineering Systems Design Programs sponsored by the National Aeronautics and Space Administration and a cooperating university or universities. The objectives of the programs are similar but the missions and background of the centers allow variations in each program. The purpose of the programs is to provide information and experience for the participants to develop multidisciplinary engineering systems design courses or programs at their home institutions. The multidisciplinary approach involves the design problem in its entirety rather than the initially unconnected viewpoint of many single disciplines. The advantages of such programs in combining the students' engineering science backgrounds with the demands for creative engineering design are unquestioned. The concomitant requirement for multidisciplinary communication is stimulating, broadening, and shows the potential contributions of engineering to society. The Engineering Systems Design Summer Faculty Programs will give each faculty participant a chance to experience the program from both the student and teacher viewpoints.

The Auburn-Alabama-MSFC participants will be involved in the complete systems design of a manned earth orbital research laboratory. All aspects of the conceptual design will be considered by the participants. The imagination of the participants will generate the complete systems approach to the problem. Multidisciplinary design teams with alternating group leaders composed of the participants will be established to undertake the design problem selected. The participants will work and live in Huntsville, Alabama. The facilities and staff of the NASA-Marshall Space Flight Center will support the group's activities. Seminars on topics directly related to the system design will be conducted during the course of the 11-week program. Appropriate speakers will be selected from NASA, industry, and research laboratories. Tours of the Marshall Space Flight Center, Manned Spacecraft Center, and other space facilities will be arranged. The work will culminate in a formal report similar to that of the 1967 program report of 520 pages entitled JOVE (Jupiter Orbiting Vehicle for Exploration), which was presented by the 1967 participants as Paper SD-1 at the 19th Congress of the International Astronautical Federation in October 1968.

GENERAL INFORMATION

Huntsville, Alabama, and the Marshall Center provide an excellent atmosphere for the NASA Engineering Systems Design Summer Faculty Fellowship Program. The city population is composed predominantly of engineers and scientists engaged in space-related research and development. The Marshall Center, directed by Dr. Wernher von Braun, is the largest NASA field center. Approximately 6,000 employees work at MSFC. The mission of the Center is the development of large space boosters and field research. More than 250 buildings with about 3 million square feet of floor space comprise the 1,800-acre facility in north Alabama. The annual payroll at MSFC exceeds $80 million. The Center personnel have a number of space-age accomplishments, which include:

- 10 successful launchings of Saturn I
- Launching of Astronauts Shepard and Grissom
- Free world's first earth satellite, Explorer I
- Free world's first sun satellite, Explorer IV
- First launching of Saturn V, the 7.5 million-pound thrust moon rocket, in November 1967

Eight laboratories at MSFC will furnish technical support to the Fellows. These laboratories are: Aero-Astrodynamics, Astrionics, Computation, Manufacturing Engineering, Propulsion and Vehicle Engineering, Quality and Reliability Assurance, Space Sciences, and Test.

The picture of the Marshall Center would be incomplete without emphasizing the support and interest of Dr. von Braun in education and in the program.

Huntsville, Alabama, is also the home of the Redstone Arsenal where the Army Missile Command conducts military rocket research. One of the oldest communities in the State, Huntsville dates from 1805 and has changed from the "Watercress Capital of the World" to the "Space Capital." The population has grown from approximately 16,000 in 1950 to 125,000 in 1967.

Transportation to and from Huntsville is provided by five major highways, two railways, and 35 scheduled airline flights per day. Direct flight service is available to Chicago, Washington, New York, Philadelphia, Detroit, Atlanta, Birmingham, Mobile, Nashville, Memphis, Knoxville, Chattanooga, New Orleans, and Miami. A new jet airport has recently been opened to serve this community.

Recreation for all tastes is convenient. The Tennessee River is 11 miles south of Huntsville, and TVA lakes are nearby. Guntersville Lake located nearby is the host for an annual unlimited hydroplane race. Monte Sano Park with 1,900 acres, 2,000 feet above sea level, overlooks the city 1,000 feet below. Picnic areas, cottages, horseback riding, and hiking are available in the park. There are four private golf courses and one 18 hole municipal course. Four bowling alleys, an ice skating rink, theaters, tennis courts, and handball courts are just a few additional attractions. The Whitesburg Yacht Club has developed the recreational facilities of the TVA lakes. The Rocket City Astronomical Society has the second largest telescope in the Southeast.

Housing is plentiful. All apartments have swimming pools and range from one to four bedroom garden or multiple unit buildings. Many feature wall-to-wall carpet, draperies, air conditioning, all electric kitchens, garbage disposals, barbecue areas, laundry facilities, and recreational rooms. Thirteen major shopping centers and a central business district handle all types of goods and services. Huntsville has a new public library and an Arts Council. Among the Arts Council activities are a Little Theatre, Broadway Theater League, and Civic Symphony. There are more than 100 churches to serve over 27 denominations.

In short, Huntsville has all the requirements for a pleasant summer for you and your family. In addition, there are several social gatherings planned for the Fellows and their families. We hope you will join us as an Engineering Design Fellow for the 1969 program.

Send request for additional information and/or completed application form to:

Dr. R. I. Vachon
Alumni Professor
Mechanical Engineering
Auburn University
Auburn, Alabama 36830
Telephone: 205-826-4574

HOST INSTITUTION

STANFORD UNIVERSITY

STANFORD, CALIF.

NASA CENTER

AMES RESEARCH CENTER

MOFFETT FIELD, CALIF.

ENGINEERING SYSTEMS DESIGN

11 weeks, 16 June–29 August 1969

PROGRAM DESCRIPTION

Twenty college and university faculty members will be chosen to perform a commuter airplane system study. There is a threefold purpose to this effort: (1) to give participants experiences and techniques that will allow them to organize multidisciplinary engineering systems design courses at their home institutions, (2) to encourage communication and collaboration between engineering and other disciplines, and (3) to provide NASA with a useful study.

Since 1963, Stanford University has offered courses in Systems Engineering to its graduate students. In these courses, the students have performed system designs on a satellite-based weather-data-collection system (SWAMI), an unmanned Mars exploration system (SAMPLER), an international weather satellite system (SPINMAP), an educational satellite system (ASCEND), and an earth resource observation system (DEMETER). The students in these programs have been from all fields of engineering and related areas, such as the pure sciences and the business school.

The student program has proved very effective in stimulating student innovation, in teaching the application of engineering theories to actual engineering problems, in establishing communication between engineers of different specialties, and in introducing the students to the potentialities and challenges of the space program. The student courses therefore accomplish one of the major objectives recommended in the **Engineering Goals Report** of the American Society for Engineering Education.

The 1969 Summer Faculty program will be the fourth held at Stanford for the purpose of allowing faculty from other schools to acquire direct experiences in such courses and to take advantage of the various approaches, classroom techniques, and organization schemes developed at Stanford. The group will participate in a system design run in a similar manner to the student system designs. The system will be complex and the team approach in interdisciplinary problem solving will be stressed. As such it will be similar in character to the three preceding Institutes, which had as design projects the following space-related topics: advanced solar probe (ICARUS), international communication satellite (SAINT), and a semipermanent scientific base on the lunar or Martian surface (MOONLAB). To supplement the system design activities, the participants will be given an opportunity to attend courses and seminars offered as part of the Stanford Summer Session, as well as short courses, workshops, and research seminars prepared especially for the Stanford-Ames Research Program.

The group will undertake a preliminary design and feasibility study of a commuter airplane system that can compete economically with high-speed surface or subsurface transportation systems. Technical developments that may make this possible include: (1) Lightweight gas turbine, turbofan, and turbojet engines weighing less than 1/10 as much as engines of the same power 30 years ago; (2) Lightweight aircraft structures including new high strength fiber composites; (3) Lightweight and highly reliable electronic systems using microelectronics, which permit redundant automatic control systems; (4) Automated guidance and control systems for midcourse and terminal guidance suitable for flying in a designated tunnel through the air; (5) Crosswind landing gears that permit landing in a designated direction independent of crosswinds; (6) Catapult and arresting gear systems such as are used on naval aircraft. The study will include an innovative technological design taking into account the human factors (safety, high accelerations and decelerations, etc.), sociological factors (minimum noise and smog contribution, scheduling problems), and cost and economic considerations.

During the first part of the course, speakers will be brought in to discuss various topics of interest. As the design progresses, Ames and Stanford experts will be used as resource people when necessary. They will also be used as jury members in design reviews and included in the audience for the final presentation. The group will produce a report on their accomplishments as a final output.

GENERAL INFORMATION

Group meetings will be held both at Stanford University and at Ames laboratory. These two institutions are approximately 15 minutes apart by car.

Inexpensive housing has been increasingly difficult to obtain during the summer months. Stanford University has a few furnished sublet apartments in its married student housing development, Escondido Village, for which the Faculty Fellows are eligible to apply. Furnished homes as summer rentals in the immediate vicinity of Stanford range in price from about $200 to $300 per month and higher. In general, Faculty Fellows with small families should be prepared to pay approximately 1 week's stipend as monthly rent for their accommodations. (In view of the relatively high living cost in the San Francisco Bay Area and the limitation of the weekly stipend, it is suggested that Fellows with above-average relocation expenses seek additional support from their home institutions.) Mrs. Jane Fajardo, Administrative Aide, will attempt to assist the Fellows in securing housing either on campus or in the neighboring communities and should be notified as early as possible if such assistance is needed.

Courtesy cards will be issued to the Fellows by Stanford University, entitling them to library use, class attendance, and most privileges enjoyed by Stanford staff and regular students, with the exception of coverage by Student Health Service. If formal credit for courses is desired, Fellows may register as nonmatriculated students (paying tuition on a per-unit basis).

PROGRAM ADMINISTRATION DIRECTORY

Co-directors:

Dr. William Bollay
Visiting Professor of Engineering
Department of Aeronautics and Astronautics
Stanford University
Stanford, California 94305

Mr. John V. Foster
Director of Development
Ames Research Center, NASA
Moffett Field, California 94035
Telephone: 415-961-1111, Ext. 2720

Send request for additional information and/or completed application form to:

Mrs. Jane Fajardo
Administrative Aide
Department of Aeronautics and Astronautics
Stanford University
Stanford, California 94305
Telephone: 415-321-2300, Ext. 3079

HOST INSTITUTION

OLD DOMINION COLLEGE

NORFOLK, VA.

NASA CENTER

LANGLEY RESEARCH CENTER

HAMPTON, VA.

ENGINEERING SYSTEMS DESIGN

11 weeks, 9 June–22 August 1969

PROGRAM DESCRIPTION

Fifteen to twenty college or university faculty members will be appointed as Fellows to spend 11 weeks at the Langley Research Center as members of a multidisciplinary design team. The team will undertake a preliminary study of a modern systems design problem. The design team will utilize the engineering systems design concept, that of approaching the design problem in its entirety rather than from the initially unconnected viewpoint of many single disciplines. The faculty comprising the design team will include, principally, individuals who are specialists in the fields of political science, economics, law, sociology, and international relations, in addition to individuals from all disciplines of engineering.

The purposes of this program are to provide the participating Fellow with (1) an opportunity to enrich his competence and allow him to develop concepts that will culminate in his organizing multidisciplinary engineering systems design programs at his home institution, (2) an opportunity to encourage communication and collaboration between engineering and other disciplines, and (3) an opportunity to provide NASA with a useful study.

The 1969 Faculty Summer Program will be the second held at the Langley Research Center. The Engineering Systems Design programs of the past have proved to be very effective. As a result of participation in these programs, systems design programs and courses have been started at various universities. These student programs have proved very effective in stimulating student innovation, in teaching the application of engineering theories to actual engineering problems, in establishing communication between engineers of different specialties, and in illustrating the great importance of such communication. They have proved very effective in teaching methods of parametric evaluation of complex system alternatives, in demonstrating the effects of one engineering, social, economic, or political aspect of the system upon all others, and in introducing the students to the potentialities and challenges of the space program.

The systems engineering project concept implies that the design team will be comprised of groups, group leaders, a project manager, and advisers. The team as a whole will commence their activity with a planning phase in the organization of the project. The topic of study, during this planning phase, will be broken down into a few major areas, each of which will be studied by a group of faculty Fellows. The Fellows are invited to select one of these groups and each group will have the proper balance of engineers and nonengineers appropriate to the task. Each group elects a group leader on a rotational basis. The team selects from its members a project manager, also on a rotational basis. Overseeing the program will be an appointed project director.

To enrich their technical competence and provide the participants with a knowledge of engineering systems design techniques, a seminar and lecture series will be conducted. Experts will be invited to lecture on systems design techniques. The appropriate technical experts will be invited from universities, NASA, and industrial organizations to lecture on the subjects related to the chosen systems design. The seminar speakers and/or lecturers will be available to the group for consultation and discussion following their presentation.

DESIGN PROJECT

The objective of the Old Dominion College–Langley Research Center program will be a preliminary design study of an earth resources satellite system. The system will have to satisfy a given set of mission objectives and will be, in general, a configuration of several subsystems. The teams' work will culminate in a formal report similar to that of the 1968 program report.

GENERAL INFORMATION

Langley Research Center has an activities building where, in the past, Fellows and their wives and children gathered in the evenings for social affairs. Langley is approximately 30 minutes from Colonial Williamsburg as it is from Yorktown and Jamestown. Langley is also only 30 minutes from Norfolk where the largest Navy base is located. Some Faculty Fellows, during the July Fourth weekend, have visited the mountains in Virginia, which are approximately 5 hours from Langley. A number of clean, wonderful beaches are within 30 minutes from Langley.

Inexpensive housing in the immediate vicinity of Langley has been increasingly difficult to obtain during the summer months. Summer rentals for furnished apartments or furnished homes range from $150 to $280 per month. Rentals in Newport News, approximately 20 minutes from Langley, and in Norfolk are less expensive. Car pools can be arranged to minimize travel costs.

Send requests for additional information and/or completed application form to:

Dr. G. L. Goglia
Professor and Chairman
Thermal Engineering Department
Old Dominion College
Norfolk, Virginia 23508
Telephone: 703-627-2931, Ext. 322

HOST INSTITUTION

STANFORD UNIVERSITY

STANFORD, CALIF.

NASA CENTER

AMES RESEARCH CENTER

MOFFETT FIELD, CALIF.

AERONAUTICS AND SPACE RESEARCH

10 weeks, 23 June–29 August 1969

PROGRAM DESCRIPTION

Twenty to twenty-five young college or university faculty members will be chosen to spend 10 weeks in cooperative research and study with the senior staff of the NASA Ames Research Center and the faculty of Stanford University. Applicants must indicate an active interest in one of the research areas of the Ames laboratory and give evidence of a minimum basic competence necessary to participate effectively in the program. To supplement the research activity at Ames, the Fellows will be given an opportunity to attend courses and seminars offered as part of the Stanford Summer Session, as well as short courses, workshops, and research seminars specially organized by Stanford for presentation at the Ames Research Center.

Research Opportunities

The Fellows participating in the Stanford-Ames Program will spend approximately 35 hours per week at the Ames Center working with individual research engineers or scientists on topics chosen from among the following fields:

Space physics and astronomy

Physical gasdynamics, Classical fluid mechanics, Aerodynamics, Boundary layer theory, Hypersonic flow

Guidance and control of space vehicles, Stochastic control theory, Stability and optical control, Control system synthesis, Instrumentation

Structural dynamics, Materials

Life sciences, Exobiology, Environmental biology, Biotechnology.

To indicate the nature of research problems available at Ames, we have listed below under two general categories the research projects of the 1968 Fellows.

Aerospace Engineering and Physical Sciences:

Aerodynamic characteristics of nonplanar wing-body configurations

Jet noise suppression feasibility study

Binary boundary layers on curved surfaces in high speed flow

The wall jet on two-dimensional curved surfaces

The effect of thermal conduction on a radiating, inviscid shock layer

Analyses of hypersonic turbulent boundary layer profiles at mach 6.5

Aerodynamic generation of noise

Energy partitioning during hypervelocity impact of loose sand targets

Implementation of the maximum principle when constraints are imposed on the trajectory

Composition of the exosphere

Planar tumbling of bodies with aerodynamic trim during atmospheric entry

The interaction between an emitting satellite and the solar wind

Microwave measurement of the electron-density profile in a supersonic arc jet

Myopotential switch

An immersible three-coil electrical conductivity velocity plasma probe

Phase estimate density function study of a PSK demodulator

Laser modulation

A study of the noise in the Ames Magnetometer

Active RC circuit synthesis

Variable-parameter active RC networks

A preliminary investigation of the ductile fracture of polycarbonate

Vaporization of lunar meteorites

A study of a laboratory prototype model of a laser vibration analyzer

Simulation of turbulence in moving-base ground flight simulators

Numerical methods for solving partial differential equations.

Biomedical Engineering and Life Sciences:

Material properties of the carotid artery

Modeling and simulation of the respiratory control system

The effects of anesthesia on blood flow distribution

Optical and acoustical spectroscopic techniques

Pacemakers

A heat and mass transfer model for a water vapor electrolysis cell

Free radical reactions in primitive earth atmospheres

The effects of temporal uncertainty on the expectancy-wave and reaction time

Bacteriophage electron microscopy

Combined gas chromatographic-mass spectrometric analysis of organic compounds

Radiolysis of aqueous solutions of HCN

Chemical analysis of a radiation-sensitive mucoid mutant and isolation of nonmucoid mutants

Study of methods for fractionation of the formose mixture and evaluation of the toxicity of its components

Separation and quantitation of phospholipids in yeasts

Abiological synthesis of lipoidal material

Food synthesis aboard a spacecraft.

Advanced Courses and Seminars at Stanford University

The Faculty Fellows are expected to spend at least 5 hours per week at Stanford University attending courses and/or seminars offered as part of the 8-week Stanford Summer Session (June 23–August 16). Most departments at Stanford offer a number of advanced as well as elementary courses during the summer. To acquaint Faculty Fellows and the Ames Research staff with recent advances in fluid and gas dynamics, the Department of Aeronautics and Astronautics at Stanford will offer a special course with this title. It will be taught by Drs. Daniel Bershader, Krishnamurty Karamcheti, Milton Van Dyke, and Walter Vincenti. Also, for Fellows with an interest in the biomedical engineering area, Drs. Leo Sapirstein and Max Anliker and a number of invited speakers will offer a coordinated lecture course on recent developments in biomedical engineering. Each of these courses will involve a total of 30 lecture hours.

Finally, a weekly lecture series will be conducted in the form of a seminar in aerospace technology directed by Dr. Howard S. Seifert.

In addition, it is planned that Dr. Rudolf Kalman will present a 2-week intensive course on modern system theory.

Short Courses, Workshops, and Research Seminars at the Ames Research Center

For Faculty Fellows whose educational background is within the field of the biomedical sciences, a 1-week intensive short course on biocybernetics (mathematical

modeling of biological systems) will be organized. To review new developments in a variety of fields, four 1-day workshops will be held at Ames in the following areas:

Space Biology: Chairman to be announced

Control Theory: Chairman, Dr. Arthur Bryson

Holography: Chairman to be announced

Aerodynamics: Chairman to be announced.

For each of the workshops one or two leading authorities will be invited to present detailed lectures on the selected topic and to conduct a research seminar that may feature as speakers also staff members of the NASA staff and the faculties of Stanford University and neighboring institutions.

GENERAL INFORMATION

The Ames Research Center can only be reached by car from Stanford University. Commuting between the two institutions takes approximately 15 minutes.

Inexpensive housing has been increasingly difficult to obtain during the summer months. Stanford University has a few furnished sublet apartments in its married student housing development, Escondido Village, for which the Faculty Fellows are eligible to apply. Furnished homes as summer rentals in the immediate vicinity of Stanford range in price from about $200 to $300 per month and higher. In general, Faculty Fellows with small families should be prepared to pay approximately 1 week's stipend as monthly rent for their accommodations. (In view of the relatively high living cost in the San Francisco Bay Area and the limitation of the weekly stipend, it is suggested that Fellows with above-average relocation expenses seek additional support from their home institutions.) Mrs. Jane Fajardo, Administrative Aide, will attempt to assist the Fellows in securing housing either on campus or in the neighboring communities and should be notified as early as possible if such assistance is needed.

Courtesy cards will be issued to the Fellows by Stanford University, entitling them to library use, class attendance, and most privileges enjoyed by Stanford staff and regular students, with the exception of coverage by Student Health Service. If formal credit for courses is desired, Fellows may register as nonmatriculated students (paying tuition on a per-unit basis).

PROGRAM ADMINISTRATION DIRECTORY

Co-directors:

Dr. Max Anliker
Department of Aeronautics and Astronautics
Stanford University
Stanford, California 94305
Telephone: 415-321-2300, Ext. 3079

Mr. John Leveen
Chief, Employee Development Branch
Ames Research Center, NASA
Moffett Field, California 94035
Telephone: 415-961-1111, Ext. 2604

Send request for additional information and/or completed application form to:

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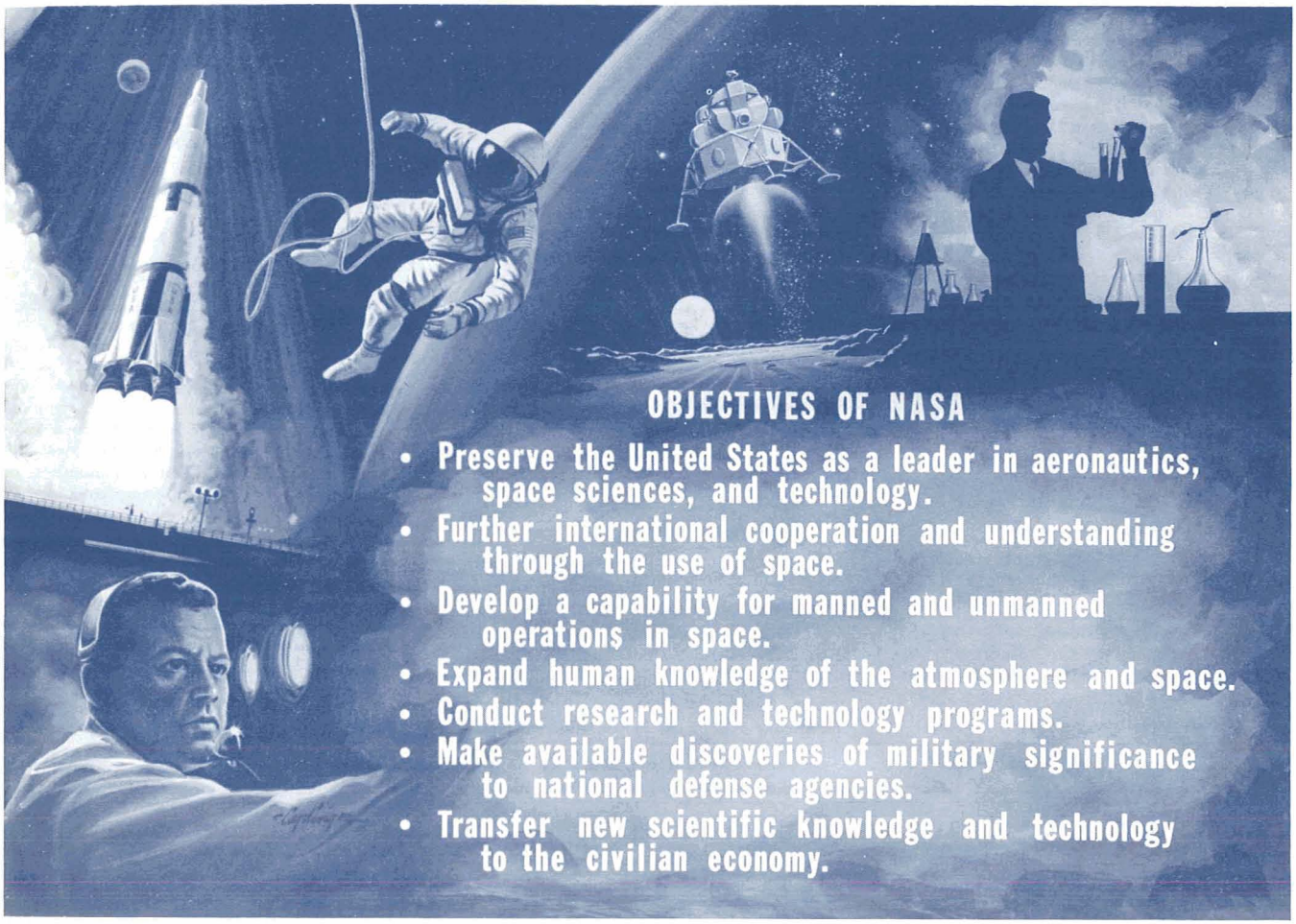

HOST INSTITUTION

THE CATHOLIC UNIVERSITY OF AMERICA

WASHINGTON, D. C.

HOST INSTITUTION

UNIVERSITY OF MARYLAND

COLLEGE PARK, MD.

NASA CENTER

GODDARD SPACE FLIGHT CENTER

GREENBELT, MD.

AERONAUTICS AND SPACE RESEARCH

10 weeks, 16 June–22 August 1969

PROGRAM DESCRIPTION

The program consists of two parts: Education (20% of total time) and research (80% of total time). The research will be conducted in Goddard Space Flight Center on projects in one of the areas listed below. The educational program will be organized by the host institutions and will include lectures and seminars on topics related to the research projects and the mission of Goddard Space Flight Center. Two short courses on communication systems and modern optics are planned. Experts from throughout the country, including faculties of the host institutions and staff members of Goddard Center, will be invited as lecturers. The research areas from the 1969 program are outlined in the following:

Communication and Telemetry

Comparison of PFM and PCM from the point-of-view of detection theory

PFM data synchronization techniques

Correlation detectors for PFM coherent telemeters

Synchronization of timing signals at remote stations

Pattern recognition by Fourier transforms

Applications of brand-limited white Gaussian noise generators

Holograms as optimum detectors and estimators of random signals

Study of the learning process of the human brain

Simulation of telemetry systems

Error detecting and correcting codes

Computers

Control center data communications study

Computing capabilities of holograms

Development of circuit analysis computer programs

Development of computer languages for remote terminals

Statistical analysis of satellite data tracking network

Multiprogrammed systems programming

Computer communication in an automated tracking network

Quantum Electronics (Lasers and Masers)

Electronic properties of materials for masers

Saturation effects on inhomogeneously broadened maser transitions

Highly precise frequency standards with hydrogen maser

Optimum techniques for automatically tuning a hydrogen maser

Antennas

Far field radiation pattern from arbitrary surfaces with arbitrary illumination

New methods for synthesizing secondary radiation patterns

Measurement techniques for precision determination of antenna electrical bore-sight and angular sensitivity

Phase stability of an electronically steerable array

Properties of low frequency antenna systems in ionized media

Automatic Control

Development of advanced control system for precision pointing of antenna structures

Development of adaptive correlation as a real time controller of precise tracking systems

Feasibility of learning systems theory to tracking and data acquisition problems

Optimal prediction for directing large antennas

Optimum utilization of Doppler and range data from synchronous platform

Structures

Modeling techniques for large ground-based antennas

Structural dynamics and thermal deflections of highly flexible space structures

Space Science

Colloid propulsion

Interplanetary and boundary plasma instabilities

Imaging properties of X-ray reflection telescopes

Special corrections to satellite tracking data due to refraction, aberration, relativity, etc.

Variability of photoelectric work functions

Millimeter waves for space communication

VLF transmission investigation in D-region

GENERAL INFORMATION

Goddard Space Flight Center is located in Greenbelt, Maryland, about a 30 minute drive from downtown Washington, D. C. Participating Faculty Fellows will have the advantages provided by well equipped libraries and laboratories. Metropolitan Washington has outstanding cultural and recreational facilities. Many sites important in American history are nearby. Family members of all ages will find this a rewarding experience.

Send request for additional information and/or completed application form to:

Dr. Bertrand T. Fang
Space Science & Applied Physics
The Catholic University of America
Washington, D. C. 20017
Telephone: 202-529-6000, Ext. 571

HOST INSTITUTION

CASE WESTERN RESERVE UNIVERSITY

CLEVELAND, OHIO

NASA CENTER

LEWIS RESEARCH CENTER

CLEVELAND, OHIO

AERONAUTICS AND SPACE RESEARCH

10 weeks, 9 June–15 August 1969

PROGRAM DESCRIPTION

Case Western Reserve University and NASA's Lewis Research Center are offering young college and university teachers of science and engineering an opportunity to participate in a 10-week summer space research program. This is the sixth consecutive summer that Case and Lewis have conducted the Summer Faculty Fellowship Program. The Faculty Fellows will spend about 90% of their time working on a research project of a type appropriate for doctoral-level professionals. The remaining 10% (about ½ day per week) will be left free for tours, lectures, and seminars of Lewis and Case.

Research Opportunities

Lewis Research Center is NASA's center for research and advanced technology in propulsion and power generation. Lewis has major efforts in all fields of propulsion, from air-breathing engines and chemical rockets to nuclear and electromagnetic rockets for deep space missions. Lewis' program in space power encompasses Brayton and Rankine turbogenerator systems, and direct energy conversion devices, such as solar cells, batteries, fuel cells, thermionic and magnetohydrodynamic generators.

In support of these programs, Lewis maintains an extensive research effort in many areas of pure and applied science and engineering. This research is carried out both in Lewis' Advanced Research Institute, which encompasses most fundamental research in physics and chemistry, and in the three large engineering research and development sectors: Aeronautics, Power, and Rockets and Vehicles.

The nature of the research performed by Faculty Fellows is illustrated by the following list of topics investigated in the 1968 program:

Elastohydrodynamic theory of spinning friction phenomena in ball bearings

Nonuniform and nonsteady flows in rotating cascades

Numerical study of unsteady mixing and diffusion

Solid-state analog of a magnetohydrodynamic generator

Analysis of stress distributions in nuclear fuel elements

Magnetohydrodynamic boundary layers

Model for low-cycle, high-stress crack propagation at cryogenic temperatures

Theory of harmonic and anharmonic effects on migration mechanism in solids

EPR studies of liquid crystal phases in paramagnetic substances

Detection of free radicals in reacting gases by EPR spectoscopy

Improved techniques for correlation of losses in highly-loaded turbine cascades

Scattered-light photoelasticity

Experimental determination of electron emission cooling in thermionic emission

Prediction of output characteristics of alternator with SCR parasitic load speed control

Growth of F-centers in alkali-halides

Nucleate boiling of water in rotating boiler subject to high accelerations

Flow visualization techniques for unsteady flow development in ducts

Experimental study of alpha-particle and deuteron induced nuclear reactions

Experimental study of the effect of electrostatic forces on fluids in zero-g environment

High magnetic field studies of salt-ion migration in water

Feasibility of heat pipes for removal of water and heat from fuel cells

Behavior of gas and vapor bubbles in an oscillating pressure field

Theoretical and experimental studies of flow fields inside diffusers with burners

Research topics are chosen by mutual agreement between the prospective Fellow and his Lewis research adviser. They are selected to provide an optimum match between the interests and background of the Fellow and the research objectives and capabilities of Lewis. Very often the Fellow initiates and acts as principal investigator on a project of his own choosing. The research experience is intended primarily to enrich and stimulate the teaching and research activities of the Fellow at his home institution, and secondarily to contribute to NASA's ongoing research program.

LECTURE AND SEMINAR PROGRAM

A program of lectures, seminars, and tours will be organized by Case Western Reserve University. Most of these will be held at Lewis Research Center. The lecturers will be drawn from Lewis and Case, other universities, and industry. The lecture topics will be chosen to be of general interest to the Fellows, and special seminars on particular research fields may be organized if there is sufficient interest. It is planned to continue the 1968 Seminar on Group Theory and its Applications to Physics and Chemistry.

GENERAL INFORMATION

The Lewis Research Center is situated on 350 acres at the Cleveland Airport and on an auxiliary location of 6,000 acres at Sandusky, Ohio. The Center comprises extensive laboratories in many buildings for almost every kind of physical, chemical, electrical, and metallurgical research. Also, unusual tools for propulsion and power technology include such items as high-speed wind tunnels of various sizes, engine test facilities that simulate altitude operation, test stands for rockets and components, space simulation chambers, and radiation sources, including a cyclotron and a 60,000-kilowatt reactor.

Case Western Reserve University is a privately endowed university formed in 1967 by the federation of Case Institute of Technology (est. 1880) and Western Reserve University (est. 1826), which are located on adjacent campuses in the University Circle area of Cleveland. The University presently has about 7,500 full-time undergraduate students, 2,500 graduate students, and a faculty of 1,300. The University's School of Engineering conducts undergraduate and graduate programs in Bio and Medical Engineering, Chemical Engineering Science, Computer, Control and Systems Sciences and Engineering, Electrical Science and Applied Physics, Fluid, Thermal, and Aerospace Sciences, Polymer Science and Engineering, and Solid Mechanics, Structures, and Mechanical Design.

Cleveland offers many cultural advantages, such as its outstanding Art Museum and the incomparable Cleveland Orchestra. The orchestra and other well-known performers are featured at a summer concert series in the beautiful new Blossom Center outdoor ampitheatre less than an hour's drive away. Lewis Research Center is surrounded by many fine residential suburbs offering pleasant living conditions away from the busy metropolitan center, but within easy driving distance of downtown attractions such as the Stadium, where the Cleveland Indians and the Stokers soccer team hold home games during the summer.

continued

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1969 NASA-ASEE SUMMER FACULTY FELLOWSHIP PROGRAMS

AERONAUTICS & SPACE RESEARCH **ENGINEERING SYSTEMS DESIGN**

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Professor C. G. Houtsma, Northeastern University, 360 Huntington Avenue, Boston, Massachusetts 02115. Telephone: 617-427-1337

Would you be willing to commit yourself to continue the research program during the summer of 1970? ☐ **Yes** ☐ **No**

Date_____ **Signature**_____

DEADLINE FOR RECEIPT OF APPLICATION AND ALL SUPPORTING MATERIAL: FEBRUARY 15, 1969

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SUPPLEMENTARY INFORMATION

On a separate sheet please give the following supplementary information:

1. Colleges attended, with dates of attendance and degrees received, area, and titles of theses and dissertations.
2. Chronology of professional employment and significant academic and professional activities.
3. List of publications.
4. Design experience.
5. Courses taught, including textbooks or reference books used.
6. Any other information you feel may be helpful.
7. Past participation in NASA-ASEE Summer Faculty Fellowship Programs.

INSTITUTES

The Institutes are listed below. You may apply for more than one institute, however, it is important that you indicate your order of preference by noting the figures 1, 2, and 3 in the appropriate box. **Submit the original documents to the Institute of first choice with copies to any other Institute to which you are applying, and send material to persons listed below.**

ENGINEERING SYSTEMS DESIGN INSTITUTES

☐ **University of Houston and Rice University—NASA Manned Spacecraft Center**
Dr. C. J. Huang, Associate Dean, Cullen College of Engineering, University of Houston, Houston, Texas 77004. Telephone: 713-748-6600, Ext. 408

☐ **Auburn University and University of Alabama—NASA Marshall Space Flight Center**
Dr. R. I. Vachon, Alumni Professor, Mechanical Engineering, Auburn University, Auburn, Alabama 36830. Telephone: 205-826-4574

☐ **Stanford University—NASA Ames Research Center**
Mrs. Jane Fajardo, Administrative Aide, Department of Aeronautics and Astronautics, Stanford University, Stanford, California 94305. Telephone: 415-321-2300, Ext. 3079

☐ **Old Dominion College—NASA Langley Research Center**
Dr. G. L. Goglia, Professor and Chairman, Thermal Engineering Department, Old Dominion College, Norfolk, Virginia 23508. Telephone: 703-637-2931, Ext. 322

AERONAUTICS & SPACE RESEARCH INSTITUTES

☐ **Stanford University—NASA Ames Research Center**
Mrs. Jane Fajardo, Administrative Aide, Department of Aeronautics and Astronautics, Stanford University, Stanford, California 94350. Telephone: 415-321-2300, Ext. 3079

☐ **Case Western Reserve University—NASA Lewis Research Center**
Dr. Frederic A. Lyman, Associate Professor, School of Engineering, Case Western Reserve University, Cleveland, Ohio 44106. Telephone: 216-368-4580

☐ **The Catholic University of America and University of Maryland—NASA Goddard Space Flight Center**
Dr. Bertrand T. Fang, Department of Space Science and Applied Physics, The Catholic University of America, Washington, D. C. 20017. Telephone: 202-529-6000, Ext. 571

☐ **Old Dominion College—NASA Langley Research Center**
Dr. G. L. Goglia, Professor and Chairman, Thermal Engineering Department, Old Dominion College, Norfolk, Virginia 23508. Telephone: 703-637-2931, Ext. 322

☐ **University of Houston and Texas A&M University—NASA Manned Spacecraft Center**
Dr. C. J. Huang, Associate Dean, Cullen College of Engineering, University of Houston, Texas 77004. Telephone: 713-748-6600, Ext. 408

☐ **University of Alabama and Auburn University—NASA Marshall Space Flight Center**
Dr. B. F. Barfield, Associate Professor and Director, Thermal/Fluid Sciences Division, Department of Mechanical Systems Engineering, University of Alabama, Box 6307, University, Alabama 35486. Telephone: 205-348-6311

☐ **California Institute of Technology—NASA Jet Propulsion Laboratory**
Dr. Hadley W. Ford, University Relations Office, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, California 91103. Telephone: 213-354-3274

☐ **Northeastern University—NASA Electronics Research Center**
Professor C. G. Houtsma, Northeastern University, 360 Huntington Avenue, Boston, Massachusetts 02115. Telephone: 617-427-1337

Would you be willing to commit yourself to continue the research program during the summer of 1970? ☐ **Yes** ☐ **No**

Date_____ **Signature**_____

DEADLINE FOR RECEIPT OF APPLICATION AND ALL SUPPORTING MATERIAL: FEBRUARY 15, 1969

Fellows will be notified approximately March 15, 1969

FELLOWSHIPS AVAILABLE

Approximately 16 new Fellowships will be available for the summer of 1969, in addition to the 14 second-year Fellowships for participants of the 1968 Case-Lewis Summer Program. Stipends will be based on the Fellow's academic salary, up to a maximum of $250/week for first-year Fellows and $275/week for second-year Fellows. Expenses for round-trip travel will be reimbursed up to a maximum of 10¢ per mile.

TIME PERIOD

The program will start on Monday, June 9, and continue through Friday, August 15, 1969. Extensions of up to 2 weeks may be granted upon request. The lectures and seminars will be held during the second to eighth weeks of the program.

HOUSING

Lewis Research Center will assist Fellows in securing suitable housing for the summer.

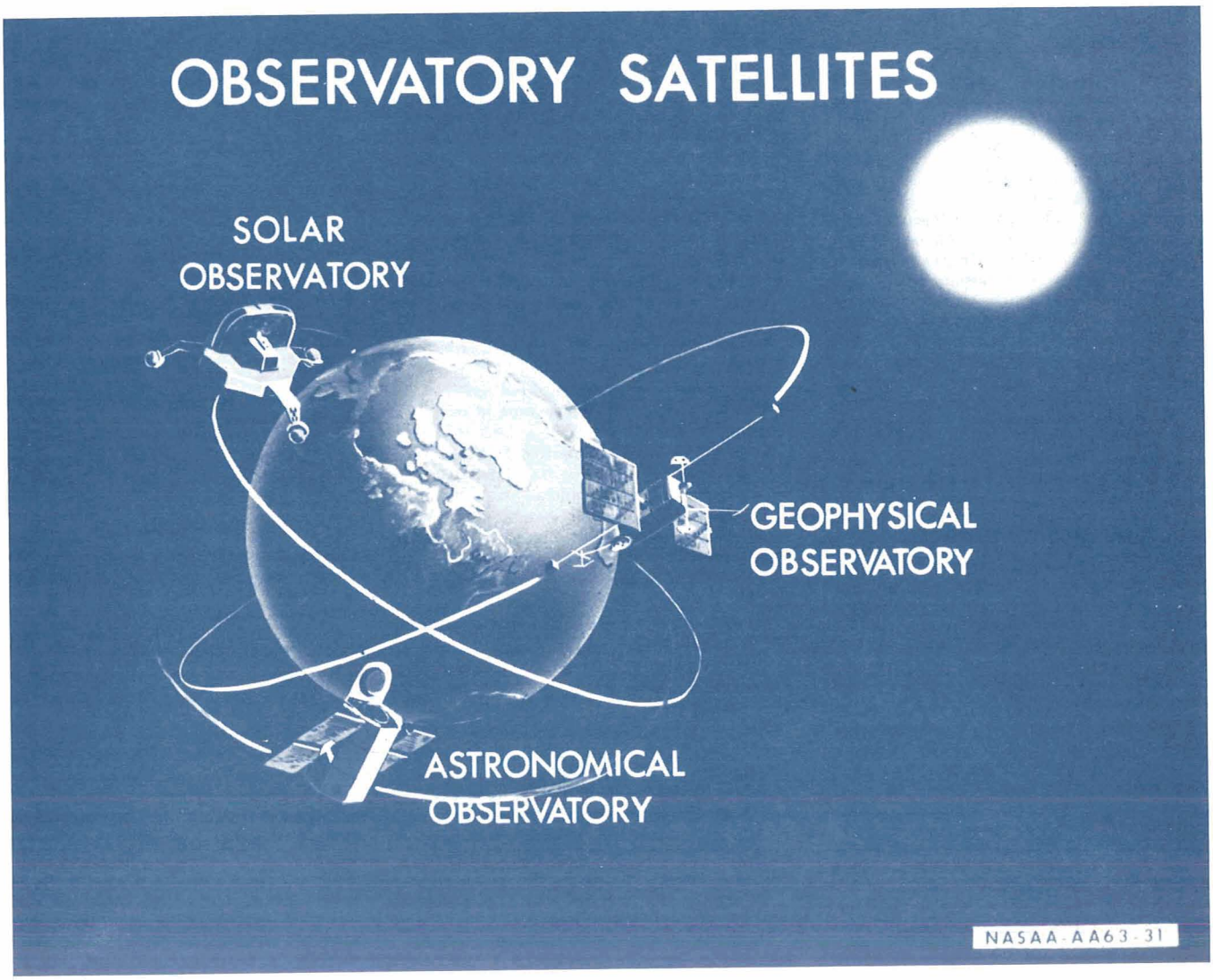
QUALIFICATIONS AND SELECTION

The program is directed toward faculty members who are engaged in research or teaching in science and engineering and related subjects and who are at an early stage of career development. The candidate should have a continuing opportunity to train graduate students. Further, it is expected that his school is not already deeply engaged in the space program.

Selection will be based first, on the appropriateness of the applicant to the intent of the program, and second, on a match between the interest and competence of the applicant and the available research opportunities.

Send requests for additional information and/or completed application form to:

Dr. Frederic A. Lyman
Associate Professor
School of Engineering
Case Western Reserve University
Cleveland, Ohio 44106
Telephone: 216-368-4580



HOST INSTITUTION

OLD DOMINION COLLEGE

NORFOLK, VA.

NASA CENTER

LANGLEY RESEARCH CENTER

HAMPTON, VA.

AERONAUTICS AND SPACE RESEARCH

10 weeks, 9 June–15 August 1969

PROGRAM DESCRIPTION

Twenty to twenty-five college or university faculty members will be appointed as Fellows to spend 10 weeks in cooperative research and study at the NASA Langley Research Center. The Fellow will devote approximately 80% of his time to a research problem and the remaining time to a study program. The study program will consist of lectures and seminars on topics of general interest or that are directly relevant to the Fellow's research project. The lecturers and seminar leaders will be distinguished scientists and/or engineers from NASA, education, or industry. The study program objective is to complement the Fellow's research interests with appropriately related study so as to enhance his competence for research and teaching in the subject area. To be an effective participant in the research program, the applicant should give evidence of a minimum basic competence and must express an active interest in one of the research areas of the Langley Research Center.

RESEARCH OPPORTUNITIES

The Langley Research Center's basic mission is to engage in objective research that will provide the technical background necessary for the accomplishment of such NASA missions as: The manned and unmanned exploration and use of space and the improvement in the performance, safety, and utility of airborne flight.

The primary objectives of Langley's research efforts are in space and aircraft dealing with unmanned earth satellites, lunar and interplanetary vehicles, launch vehicles, manned earth satellites, ballistic missiles, maneuverable missiles, hypersonic aircraft, supersonic aircraft, subsonic aircraft, and special type aircraft. As is evident, the Langley Research Center is engaged in research on a broad front, which can be divided into the following categories:

Aerodynamics: Configuration, Stability, Performance, and Control

Structures

Materials

Operating Problems

Fluid Mechanics: Heat Transfers, Real Gas Effects

Mechanics of Flight

Energy Conversion

Space Environmental Physics

Each applicant selected will receive a list of some 100 research projects from which he may choose one. The individual is also given the opportunity of proposing a topic of his own and should it be of interest to the Langley Research Center it could very well be his project. The nature of the research problems available at the Langley Research Center is partly reflected in the following listing of research problems undertaken by 1968 Fellows.

Temperature measurements problems

The influence of film cooling on the aerodynamic heating of re-entry vehicles

Transport properties of high temperature CO_2-N_2-A mixtures

Downstream cooling by localized upstream transpiration on a 7.5 degree cone in radiative equilibrium

Open cavity flow heat transfer

Calculations of turbulent boundary layer on a moving-belt ground plane

A preliminary investigation into the nonequilibrium flow behavior of a Mars atmosphere model in a hypersonic wind tunnel

Aeroelasticity equations for a nonsymmetrical thermally stressed wedge

Dynamic buckling of shallow rectangular doubly-curved shells

Crack propagation at high stress levels

Dynamic buckling of a circular cylinder with hinged ends

Dynamic interaction of a rubber tire with a soil

Computations of the response at various locations within the lunar orbiter spacecraft due to specific flight inputs

Effect of compressible loads on the vibrations of isotropic and honeycomb conical frustum shells

The investigation of oxidation and structural stability of superalloys

Structural synthesis of a stiffened conical shell

Superconducting thin-film tunneling junctions

High altitude temperature sensor

Radar system studies

Study of the mechanism of the formation of imidazopyrrolones by pyrolsis of salt precussors

Preparation of a semiconducting pyrrone polymer

Electron paramagnetic resonance study of beryllium-doped and magnesium-doped silicon

Growth and orientation studies of cadium sulfide single crystals

Light-induced modulation of absorption

Application of optimal control theory to design of autopilot for reduction of acceleration inputs to passengers

Bioastronautics

Study of the procurement cycle at the Langley Research Center

A limited number of faculty from schools other than engineering, such as science, liberal arts, business, and medical, will be invited to participate in the program.

Each Faculty Fellow will be assigned to a senior engineer or scientist at the Langley Research Center who will act as his research adviser. A short time after his selection, the Fellow will be contacted by his research adviser and given more details relevant to his research problem.

GENERAL INFORMATION

Langley Research Center has an activities building where, in the past, Fellows and their wives and children gathered in the evenings for social affairs. Langley is approximately 30 minutes from Colonial Williamsburg, Yorktown, and Jamestown. Langley is also only 30 minutes from Norfolk where the largest Navy base is located. Some Faculty Fellows, during the July Fourth weekend, have visited the mountains in Virginia, which are approximately 5 hours from Langley. A number of clean, wonderful beaches are within 30 minutes from Langley.

Inexpensive housing in the immediate vicinity of Langley has been increasingly difficult to obtain during the summer months. Summer rentals for furnished apartments or furnished homes range from $150 to $280 per month. Rentals in Newport News, approximately 20 minutes from Langley, and in Norfolk are less expensive. Car pools can be arranged to minimize travel costs.

Send requests for additional information and/or completed application form to:

Dr. G. L. Goglia
Professor and Chairman
Thermal Engineering Department
Old Dominion College
Norfolk, Virginia 23508
Telephone: 703-627-2931, Ext. 322

HOST INSTITUTION

UNIVERSITY OF HOUSTON

HOUSTON, TEX.

HOST INSTITUTION

TEXAS A&M UNIVERSITY

COLLEGE STATION, TEX.

NASA CENTER

MANNED SPACECRAFT CENTER

HOUSTON, TEX.

AERONAUTICS AND SPACE RESEARCH

10 weeks, 9 June–15 August 1969

PROGRAM DESCRIPTION

This will be the fourth year the Summer Faculty Fellowship Program is conducted by University of Houston, Texas A&M University, and NASA Manned Spacecraft Center. The Program provides the Summer Faculty Fellows with the opportunity to participate in research and development activities at the NASA Manned Spacecraft Center and the educational opportunities at the University of Houston. A Faculty Fellow is encouraged to attend the special courses and seminars in the fields related to space exploration, which are given at the University by distinguished scientists and engineers.

For the research and development activities at Manned Spacecraft Center, each Faculty Fellow will be assigned to a senior engineer or scientist at MSC who will act as his research adviser. Each Fellow will be expected to spend full time on a selected research subject at MSC except for the time he attends the lectures and seminars at the University of Houston.

RESEARCH OPPORTUNITIES

The Manned Spacecraft Center is engaged in a strong supporting research and technology program necessary for conducting the initial manned explorations of space and the preparation of unique measuring techniques and apparatus for full appraisal of the space environment compatible with the extensive earth-based data-gathering support systems. The Manned Spacecraft Center programs offer unique opportunities within the varied aspects of space flight. These opportunities lie in the following fields of study.

Science and Applications Research

The Lunar and Earth Sciences Division offers theoretical and experimental research in geology, geochemistry, geophysics, and the mapping sciences. Specific research programs are available in the mineralogy, petrology, and chemistry of meteorites, tektites, and volcanic rocks; geochemical and geophysical investigations of terrestrial rocks; field investigations of volcanic and impact craters; and planetary observations including remote geological, geochemical, and geophysical sensing. Research is also available to develop data reduction and interpretation techniques utilizing imagery acquired from space. In addition to geology and geophysics, disciplines covered include geodesy, photometry, and photogrammetry. Experimental and laboratory facilities to support these programs include a well-equipped geochemistry laboratory, geophysics (seismic, IR, photometry) laboratories, the Lunar Receiving Laboratory with its extensive bioscience facilities and the low-level radioactivity counting laboratory. This facility also includes an organic and rare gas mass spectrometry laboratory. A complete mapping sciences laboratory, and a data bank with all Gemini, Ranger, Surveyor, and Lunar Orbiter photography and the associated reduction facilities are also available.

The Space Physics Division has research programs in meteoroid sciences, atmospheric physics, cosmic rays, stellar astronomy, and solar and interplanetary medium physics. Topics of special interest include experimental measurements of meteoroid fluxes and velocities, lunar atmosphere measurements and analysis, aeronomy, M-regions, angular momentum transfer between the sun and the interplanetary medium, solar flare mechanisms, and experiments on high energy ($>10^9$ e v) cosmic rays. Astronomy experiments outside the spectral regions transmitted by the atmosphere are also of interest. In addition to various spaceflight experiments, research facilities include a worldwide network of solar radio and optical (H_α) telescopes, well-equipped optics and electronic laboratories, radiation sources, high and low velocity impact ranges, and vacuum facilities.

Medical Research

Space Medicine and Environmental Physiology. Biomedical scientists at Houston's Manned Spacecraft are responsible for managing a broad research program in support of manned space flight. This program is directed toward acquiring definitive data regarding the effects of the space environment on man in order to provide guidance to spacecraft designers and mission planners; defining critical physiological variables to be monitored in order to best assess the functional status of man in the space environment; defining and developing the necessary techniques and instrumentation required for the acquisition of these data; defining those factors of the space flight environment that induce physiological dysfunction in man; recommending procedures for mitigating or eliminating these adverse influences and/or devising countermeasures (preventive or remedial) to neutralize their effects; and defining human requirements for sustenance, optimum habitability, and social-psychological well-being with respect to long duration space missions. This broad, multidisciplinary mandate to acquire new knowledge includes, but is not limited to, the fields of microbiology, biochemistry, hematology and immunology, cardiovascular and pulmonary physiology, neurophysiology, and behavioral psychology.

In the Bioscience Laboratories of the Lunar Receiving Laboratory, a major research effort has been initiated to provide a unique integrated program for the detection and characterization of extraterrestrial life forms that may represent a hazard to a living system within the terrestrial biosphere. The laboratory is also utilized and available for study of the microbiological, virological, and immunological aspects of manned spaceflight.

Engineering and Development

Information Systems. Research is required to develop an on-line computer-aided system for the analysis and design of advanced communications systems, to increase analytical capability in the application of optimization techniques as applied to communication system design, to pursue frequency modulation threshold extension studies, and to investigate limiter-phase detector interactions on signal-to-noise performance.

Engineering effort is required for the development of techniques for computer-enhancing digitized video data applicable to mission control and experiments; prototype systems for manipulating data bases; optical scanning and complementing pattern recognition software to meet unique requirements for manned spaceflight.

Life Support Space Suits and Crew Equipment Systems. Research and development is being conducted on environmental control systems to support longer flight durations. This consists of the concentration and conversion of CO_2 into breathing oxygen and the purification and/or electrolysis of water. In addition, design and analysis of advanced temperature control systems continues. Advanced space suit configurations are being developed and supporting hardware defined such as high-performance portable environmental control systems and extravehicular

aids. Supporting research programs concerned with improved nonmetallic materials for use in the design and development of space suits and crew equipment are conducted. Analytical and prototype design work is conducted on improved food, water, and waste management systems.

Computer Science and Application. Research is required in three categories:

Physics—in conjunction with the development of atmospheric models. Research studies fall into such areas as quantum mechanics, scattering theory, molecular structure theory, and plasma kinetic theory.

Mathematical Analysis—Research studies fall into areas such as approximation theory, numerical analysis, theory of ordinary and partial differential equations, theory of operators, potential theory and its recent developments via Choquet theory, and mathematical statistics.

Optimal Control Theory—Research studies include areas such as system simulations, process identification, specification of optimal criterion functions, dynamic modeling, and statistical control theory.

Facilities available for research studies include sophisticated digital, analog, and hybrid computer systems.

Instrumentation and Electronic Systems Division. Further and continuing research is required to provide optimal data management, recording, and telemetering of spacecraft performance, flight, and experimental data; in simply generated but efficient error correcting codes; in radio frequency communications, tracking, and television systems; in optimal modulation techniques; in spacecraft antennas; in advanced spacecraft microwave radar and tracking systems; in optical frequency communications and tracking techniques.

Guidance and Control. Research continues into theoretical guidance and control systems analysis including theory and techniques for navigation and guidance of manned spacecraft in interplanetary and lunar flight. Steering logic, trajectory analysis, and astrodynamics will be explored. Acceptance criteria for programs written for onboard guidance computers are being developed, as are guidance systems parameters and criteria. These systems include both manual and automatic controls. Laboratory facilities to support simulation studies of these systems are in development. These facilities include both computational and simulator devices, such as cockpit controls.

Spacecraft Propulsion and Power Generation. Research is to be conducted in the areas of main and auxiliary spacecraft propulsion systems, electrical power generation systems including solar, nuclear, and chemical energy sources, and stored energy systems. Basic information, such as requirements, characteristics, criteria, and best methods of use, will be derived from analytical studies conducted on spacecraft systems, main propulsion system components, the reaction control systems, fuel cells, pyrotechnics, gas generators, cryogenic reactants, etc. More specific and continuing research is required in areas such as vacuum ignition, partial combustion effects, and effects of entrained gas in propellants.

Structures and Mechanics Division. Research and analysis are being conducted to define problem areas in spacecraft structures, materials applicability, thermal protection, and thermal control; and to obtain an optimized solution to specific problems within the aforementioned areas. Space simulators, environmental chambers, and completely equipped laboratories in material sciences are available for research and analysis work.

Aerodynamics and Flight Dynamics. Research continues into theoretical and experimental investigation of the stability and control of spacecraft shapes, drag, and heating due to flight in earth and planetary atmospheres. Studies of vehicle dynamics in orbits and during entry into earth and planetary atmospheres are also being conducted. These studies include formulation of mathematical models for use in simulations, determination of control requirements, and investigation of various control techniques.

Advanced Subsystem Requirement Prediction. An area of research has been established to develop gross-level prediction methods for the weights, power requirements, costs, and development leadtimes of advanced subsystems. Research is oriented toward advanced systems analysis and program planning and will enable a rapid assessment of the physical size and development requirements of a spacecraft designed for an advanced mission.

LECTURES AND SEMINARS AT THE UNIVERSITY OF HOUSTON

The following four lecture and seminar series are planned for the Summer Faculty Fellows.

Engineering, Design, and Operation of Manned Spacecraft

History of space flight; mission plan for a space mission; aerodynamic drag and stability; aerodynamic heating; space environment; structural loads; structural concepts and materials; temperature control and heat protection; physiology of space; life support systems; crew station layout; electrical power systems; guidance and navigation problems; automatic stabilization and control systems; onboard propulsion and reaction control systems; solid and liquid rockets; pyrotechnics; electronic systems; launch vehicles and launch vehicle interfaces; design integration; landing systems; mission analysis; mission control systems and network; mission control; recovery; summary of design and operational philosophy.

Advanced Spacecraft Fabrication Technology

Structural criteria; advanced welding technology; power metal shaping; composite and expandable structures; lightweight, self-evacuating insulation system; temperature control coatings; decontamination and sterilization; structural alloys, adhesive bonding and secondary bonding; machining; fabrication of large rocket motor cases; Apollo—design philosophy, material and processes rationale, material and manufacturing; Mercury; Gemini; Saturn; Minuteman; Atlas; Reentry and its thermal problems; thermal protection systems.

Hybrid Computer Application and Simulation in Space Engineering

Review of analog and digital programming concepts—with special emphasis on hybrid requirements, the scope of hybrid computation; system specifications, matching performance criteria with area of application; analog-to-digital and digital-to-analog interfacing; simple applications of hybrid computers, patchable logic and iterative computation; error analysis techniques, sampling errors, static and dynamic errors; design and use of hybrid software; executive routines, recursive routines; trap processing; digital simulation software; simulation of sampled data systems and random processes; numerical integration by hybrid techniques; maintenance, diagnostic, and other programming aids; optimization theory and applications to multiparameter systems, trajectory optimization, guidance and control, mission design and analysis; partial differential equations; error compensation methods; management of hybrid facilities.

Advanced Seminars in Space Engineering and Science

Special seminars on the topics related to advanced space science will be given by distinguished scientists and engineers. For example, the speakers for the 1967 Summer Faculty Fellowship Program included Nobel Laureates Libby and Urey, Congressman Casey, and Astronaut-scientist Harrison Schmitt.

GENERAL INFORMATION

As the nation's sixth largest city and third largest port, Houston is renowned for its educational and scientific facilities, which include University of Houston, Rice University, NASA Manned Spacecraft Center, the Texas Medical Center, and many other industrial research organizations.

Houston boasts four major theatres and a number of suburban amateur theatres. Year-round professional entertainment is offered, featuring top names in show business. The Houston Symphony Orchestra is one of the nation's outstanding musical groups. The Houston Museum of Fine Arts exhibit of paintings and other art forms, a $6 million collection, is composed of distinguished works from almost every notable era. The new Burke Baker Planetarium is a part of the Houston Museum of Natural Science, located at the edge of beautiful wooded Hermann Park. Hermann Park is the setting for Houston Zoological Gardens, where there are more than 2,000 animals displayed in modern buildings and outdoor exhibits, and an aviary where more than 200 exotic birds are shown.

Sports abound in Houston and the visitor can find almost any kind of recreation he desires.

Houston undoubtedly has more air conditioning than any other city in United States; not only hotels, stores, and office buildings, but also public schools, apartments, homes, and autos are air conditioned.

Send request for additional information and/or completed application form to:

Dr. C. J. Huang
Associate Dean
Cullen College of Engineerings
University of Houston
Houston, Texas 77004
Telephone: 713-748-6600, Ext. 408

HOST INSTITUTION

THE UNIVERSITY OF ALABAMA

UNIVERSITY, ALA.

HOST INSTITUTION

AUBURN UNIVERSITY

AUBURN, ALA.

NASA CENTER

MARSHALL SPACE FLIGHT CENTER

HUNTSVILLE, ALA.

AERONAUTICS AND SPACE RESEARCH

10 weeks, 9 June–15 August 1969

PROGRAM DESCRIPTION

The University of Alabama, Auburn University, and Marshall Space Flight Center invite you to spend the summer at the Marshall Center, Huntsville, Alabama, as an ASEE-NASA Summer Faculty Fellow. The Marshall Center, directed by Dr. Wernher von Braun is the largest NASA field center. Approximately 6,000 employees work at MSFC. The mission of the Center is the development of large space boosters for Saturn/Apollo and earth orbiting vehicles for advanced Apollo programs. More than 250 buildings with about 3 million square feet of floor space comprise the 1,800-acre facility in north Alabama. The annual payroll at Marshall exceeds $80 million. The Center personnel have a number of space-age accomplishments including:

10 successful launchings of Saturn I

4 successful launchings of Saturn I-B

Launching of Astronauts Shepard and Grissom

Free world's first earth satellite, Explorer I

Free world's first sun satellite, Explorer IV

Two launchings of Saturn V, 7.5 million pound thrust moon rocket.

The summer research period will include seminars on space engineering and science, and tours of the Marshall Center and the Manned Spacecraft Center in Houston. The research opportunities are extensive and challenging. Each participant will be assigned to one of the eight laboratories at the Marshall Center. These laboratories with their primary divisions are:

Aero-Astrodynamics Laboratory: Aerospace Environment, Aerophysics, Flight Test Analysis, Dynamics and Flight Mechanics, Astrodynamics and Guidance Theory.

Astrionics Laboratory: Guidance and Control, Inertial Sensors and Stabilizer, Instrumentation and Communications, Electrical Systems Integration.

Computation Laboratory: Engineering Systems, Industrial Systems, Digital Projects, Simulation.

Manufacturing Engineering Laboratory: Mfg. Research and Techniques, Mfg. Development, Planning and Tool Engineering.

Propulsion and Vehicle Engineering Laboratory: Materials, Structures, Propulsion, Vehicle Systems.

Quality and Reliability Assurance Laboratory: Reliability Assurance, Quality Engineering, Analytical Operations, Vehicle Systems Checkout.

Space Sciences Laboratory: Nuclear and Plasma Physics, Physics and Astrophysics, Scientific Payloads, Space Thermophysics.

Test Laboratory: Components and Subsystems Test, Test Instruments and Control, Systems Test.

It is impossible to enumerate all the possible work locations, but the previously mentioned laboratories and branches should indicate areas of current interest.

GENERAL INFORMATION

Huntsville, Alabama, is also the home of the Redstone Arsenal where the Army Missile Command conducts military rocket research. One of the oldest communities in the state, Huntsville dates from 1805 and has changed from the "Watercress Capital of the World" to the "Space Capital." The population has grown from approximately 16,000 in 1950 to 125,000 in 1967.

Huntsville has a number of firsts:

English-speaking community in Alabama

Public water system in America

Bank in Alabama

Protestant church in Alabama

Commercial hotel in Alabama

Free world satellite

U.S. sun satellite

Masonic lodge (Helion No. 1)

Capital in Alabama

Transportation to and from Huntsville is provided by five major highways, two railways, and 35 scheduled airline flights per day. Direct flight service is available to Chicago, Washington, New York, Philadelphia, Detroit, Atlanta, Birmingham, Mobile, Nashville, Memphis, Knoxville, Chattanooga, New Orleans, and Miami. A new jet airport has recently been opened to serve this community.

Recreation for all tastes is convenient. The Tennessee River is 11 miles south of Huntsville, and TVA lakes are nearby. Guntersville Lake, which is nearby, is the host for an annual unlimited hydroplane race. Monte Sano Park with 1,900 acres, 1,600 feet above sea level, overlooks the city some 1,000 feet below. Picnic areas, cottages, horseback riding, and hiking are available in the park. There are four private golf courses and one 18 hole municipal course. Four bowling alleys, an ice skating rink, theaters, tennis courts, and handball courts are just a few additional attractions. The Whitesburg Yacht Club has developed the recreational facilities of the TVA lakes. The Rocket City Astronomical Society has the second largest telescope in the Southeast.

Housing is plentiful. All apartments have swimming pools and range from one to four bedroom garden or multiple unit buildings. Many feature wall-to-wall carpet, draperies, air conditioning, all electric kitchens, garbage disposals, barbecue areas, laundry facilities, and recreational rooms. Thirteen major shopping centers and a central business district handle all types of goods and services.

Huntsville has a new public library, and an Arts Council. Among the Arts Council activities are a Little Theatre, Broadway Theater League, and Civic Symphony. There are more than 100 churches to serve over 27 denominations.

In short, Huntsville has all the requirements for a pleasant summer for you and your family. In addition, there are several social get-togethers planned for the Faculty Fellows and their families. We hope you will join us as a Faculty Fellow for the 1969 Program.

Send request for additional information and/or completed application form to:

Dr. B. F. Barfield
Assoc. Prof. and Director
Thermal/Fluid Sciences Division
Dept. of Mechanical Systems Engineering
University of Alabama
Box 6307
University, Alabama 35486
Telephone: 205-348-6311

HOST INSTITUTION

CALIFORNIA INSTITUTE OF TECHNOLOGY

PASADENA, CALIF.

NASA CENTER

JET PROPULSION LABORATORY

PASADENA, CALIF.

AERONAUTICS AND SPACE RESEARCH

10 weeks, 23 June–29 August 1969

PROGRAM DESCRIPTION

Research Opportunities

Fellows will spend up to 32 hours per week at the Jet Propulsion Laboratory working with an individual engineer, scientist, or team. Research and advanced development areas will include:

Guidance and control
Spacecraft power
Telecommunications
Systems engineering
Space science
Engineering mechanics
Propulsion
Environmental engineering

Some examples of the large variety of possible assignments are: Optimal trajectory design of multiple missions; applications of optimal control theory to multiple mid-course correction maneuvers and terminal guidance problems; battery development for advanced planetary missions; studies of electrochemical processes; optimal signal acquisition; demodulation and detection in space communications; acoustics and vibration research; thermal physics and magnetic pinch studies; hypersonic and hypervelocity aerodynamics; temperature control mechanisms; solid mechanics, aerothermodynamics, three dimensional image reconstruction; computer controlled self search microscopy; mass spectrometry data compression algorithms; biomedical instrumentation; gas chromatography/mass spectrometry, entry mass spectrometry, and aerometry instrumentation; solar wind simulation; image enhancement; quantum electronics in space communications; computer-aided systems testing; celestial mechanics and radio tracking; combustion of solid and liquid propellants; plasma physics related to power conversion and propulsion; heat transfer and gas dynamics related to propulsion.

Seminar in Spacecraft Technology

Caltech will offer a special Spacecraft Technology Seminar involving a total of 60 lecture hours. The seminars will emphasize current problems and the state-of-the-art, as well as provide a survey for nonspecialists. It is expected that all Fellows will attend the seminar, and the seminars will reflect the diverse interests of the Fellows.

The topic will be introduced from a systems engineering viewpoint, followed by seminars covering:

Selection of experiments
Science and instrumentation
Orbital and trajectory determination
Guidance and control
Spacecraft management
Selection and design of power systems
Design and operation of telecommunications systems
Mechanical design of the spacecraft
Confirmation of design
Spacecraft materials
Environmental requirements
Propulsion systems
Review and summary from a systems management perspective

Speakers will be selected from JPL, Caltech, and the local university and aerospace communities.

LOCALE

Greater Los Angeles offers many recreational activities such as surfing, boating, and deep sea fishing in the Pacific; numerous mountain resort areas; desert spas like Palm Springs about 1½ hours from Pasadena; two major league baseball teams; world famous Disneyland and Marineland. Many cultural events are also available such as plays, concerts, and lectures at the Civic Center, Hollywood Bowl, and UCLA campus to name a few. In the summer, temperatures at the beaches are in the 70's, but may increase to the 80's and 90's further inland; however, night temperatures are usually quite comfortable. Rain is most unusual in the summer in this area except for occasional thunderstorms in the mountains and desert areas.

PROGRAM CO-DIRECTORS

Dr. Joel N. Franklin
Division of Engineering and Applied Science
California Institute of Technology
Pasadena, California 91109
Telephone: 213-795-6841, Ext. 1621

Dr. Hadley W. Ford
University Relations Office
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91103
Telephone: 213-354-3274

Send request for additional information and/or completed application form to:

Dr. Hadley W. Ford
University Relations Office
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91103
Telephone: 213-354-3274

HOST INSTITUTION

NORTHEASTERN UNIVERSITY

BOSTON, MASS.

NASA CENTER

ELECTRONICS RESEARCH CENTER

CAMBRIDGE, MASS.

AERONAUTICS AND SPACE RESEARCH

10 weeks, 16 June–22 August 1969

PROGRAM DESCRIPTION

Northeastern University and the National Aeronautics and Space Administration's Electronics Research Center at Cambridge, Massachusetts, invite you to spend 10 weeks of next summer in the Boston area as an ASEE-NASA Summer Faculty member. The Electronics Research Center, under the direction of Mr. James C. Elms, conducts basic and applied electronics research oriented to advanced space and aeronautical missions of the future. The Center has around 800 employees and is growing. Research activities are divided into four general areas under which are grouped nine special laboratories.

The four research divisions are Electronics Components, Guidance and Control, Instrumentation and Data Processing, and Electromagnetic Research.

The summer research areas will include space optics, computer research, power conditioning and distribution, component technology, qualifications and standards, guidance, control, and microwaves.

Fellows will select research topics under the guidance of a research associate. Each Fellow will be furnished with a list of research topics and will be asked to choose three topics in accordance with his priority. The final choice will be made prior to the Fellow's arrival in Boston.

Fellows will spend 80 to 90% of their time working in one of the research areas under the direction of a senior scientist or engineer from ERC's staff.

The remaining time will be devoted to seminars and workshops where the most recent topics in aerospace technology will be presented by professional staff drawn from industry and nearby centers of learning. Seminar topics will include: Space optics, solid state electronics, automatic computation and control, and human behavior in multidisciplinary group activity. Seminar learning experiences will be reinforced by field trips to industrial research installations as the need indicates.

GENERAL INFORMATION

Boston is a center of technology and the hub of a complex of electronic research activities. Here within a small radius exists the mecca of the electronics world. Your experience at the Summer Faculty Fellowship program should enable you to go back to your campus environment with a solid acquaintance with the disciplines that are involved in the space program. This experience may well enable you to do further research on your own initiative or to introduce new views on research on your own campus.

The "new" Boston will surprise you with its modern buildings and shopping centers. The Prudential Complex is a matter of blocks from the Northeastern University campus. The "old" Boston with the Old Burying Ground and the many other scenes of historical interest have been preserved and are readily accessible by the convenient transportation.

The beautiful New England States and seacoast are within easy reach by modern parkway from the center of Boston. History becomes alive along Chestnut Street in Salem as well as on the sandy beaches of Cape Cod. Northeastern University is adjacent to the Museum of Fine Arts, next to Symphony Hall, and a short ride from the summer art centers of Rockport. Summer theaters are numerous.

Arrangements are proceeding to attempt to provide temporary housing in a women's dormitory so that families may relocate themselves later in apartment dwellings if they so desire. The Northeastern Program Coordinator is also working toward the possibility of making prior arrangements for apartment leasing in the Boston area.

Faculty identification cards and temporary parking stickers will be issued to participating Faculty Fellows. Library privileges will be extended.

Several social events are being planned in order to acquaint the Faculty Fellows, their wives, and families with one another. An opening dinner and a commencement ceremony will be held in nearby Weston, Massachusetts, at the University's Henderson House.

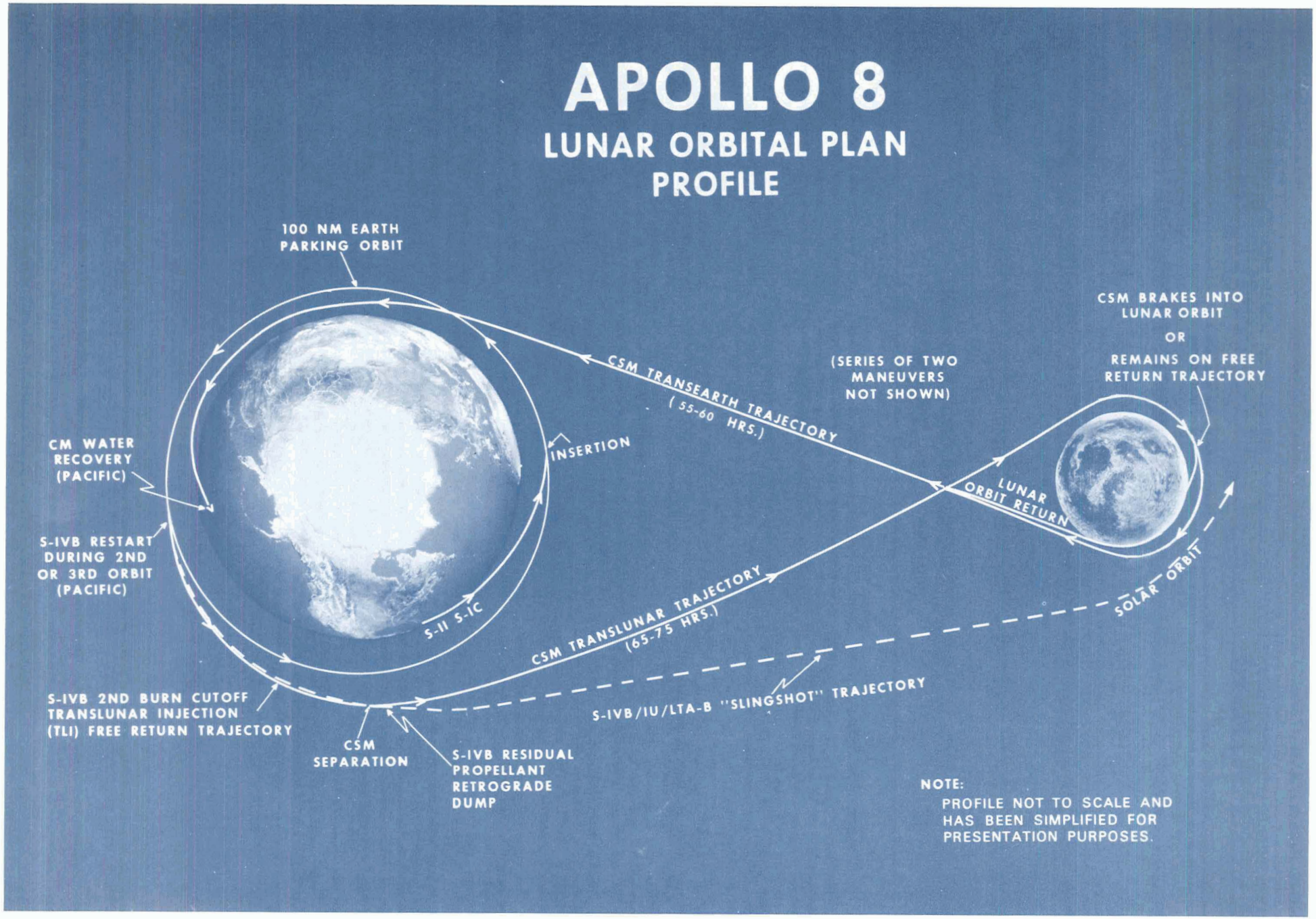
We hope you can join us as a Faculty Fellow for the 1969 Program.

Send request for additional information and/or completed application form to:

Professor C. G. Houtsma
Northeastern University
360 Huntington Avenue
Boston, Mass. 02115
Telephone: 617-427-1337

APOLLO 8

LUNAR ORBITAL PLAN PROFILE



NOTE:
PROFILE NOT TO SCALE AND HAS BEEN SIMPLIFIED FOR PRESENTATION PURPOSES.

HOST INSTITUTION

UNIVERSITY OF HOUSTON

HOUSTON, TEXAS

HOST INSTITUTION

RICE UNIVERSITY

HOUSTON, TEXAS

NASA CENTER

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS

ENGINEERING SYSTEMS DESIGN

11 weeks, 9 June–22 August 1969

GENERAL OBJECTIVES

Design Fellowships will be awarded to engineering and science faculty members to participate, as members of multidisciplinary design teams, in the ongoing activities of the space program with the attendant confrontation with the most modern systems design problems. The engineering systems concept, that of approaching the design problem in its entirety rather than from the initially unconnected viewpoint of many single disciplines, will be utilized by design teams.

Principal objective of the program is to allow the participating Fellows to increase their competence and to develop concepts that will enable them to organize multidisciplinary engineering systems design courses at their home institutions. Such system design concepts have proved to be highly effective in stimulating student innovation and in teaching the application of engineering theories to actual engineering problems. Also, the program will promote the establishment of communication between engineers and scientists in different specialties and help illustrate the importance of such communication; aid in teaching methods of parametric evaluation of complex system alternates; and introduce the students to the potentialities and challenges of the United States' space program.

DESIGN PROJECT

The objective of the Houston-Rice-Manned Spacecraft Center program is to design a vehicle related to the manned space exploration program. The system must satisfy a given set of mission objectives and will be, in general, a configuration of several subsystems such as communication, environmental control, crew system, stabilization and guidance, display and control, structure and heat shields, power and propulsion, and re-entry and landing. The systems should be relatively simple, lightweight, and reliable. They must be stable and require simple control and guidance. The systems should be capable of safe re-entry and landing. Design teams will be established with membership from several scientific and engineering disciplines, i.e., aerospace, mechanical, electrical, chemical, structural, control and industrial engineering, and physics and biology.

The Systems Design project for 1969 will be an advanced lunar exploration system to land and support man and equipment on the moon and provide for a safe return to earth using modified Apollo hardware where applicable. The principal goal of this effort will be to provide a greatly increased astronaut exploration time in man-days on the moon. This will be done with minimum cost and leadtime as the primary objectives.

Operational deviations from the present Apollo design that show promise will be considered. Some of these are direct and indirect lunar landings, direct and indirect launches for earth landing, and the use of various lunar and earth parking orbits for launch platforms.

Appropriate technical experts from the University of Houston, Rice University, NASA-MSC, and other schools and industrial organizations will conduct seminars on subjects related to the chosen system design. Field trips will be arranged to NASA-MSC and related facilities.

APPLICANTS

Applicants should be instructors, professors, or research staff members of colleges or universities, preferably with two or more years of teaching experience. Preference will be given to faculty who apply as a team representing at least two different areas of engineering or science from the same institution, and whose administration is interested in enhancing the application of systems design at their university after the completion of the fellowship program.

GENERAL INFORMATION

As the nation's sixth largest city and third largest port, Houston is renowned for its educational and scientific facilities, which include University of Houston, Rice University, NASA Manned Spacecraft Center, the Texas Medical Center, and many other industrial research organizations.

Houston boasts four major theatres and a number of suburban amateur theatres. Year-round professional entertainment is offered, featuring top names in show business. The Houston Symphony Orchestra is one of the nation's outstanding musical groups. During regular season, the 90-piece orchestra performs in Jones Hall for the Performing Arts under the direction of Andre Previn, and during the summer the group plays in the open-air Miller Theatre. The Houston Museum of Fine Arts exhibit of paintings and other art forms, a $6 million collection, is composed of distinguished works from almost every notable era. Spectacular celestial shows at Houston's new Burke Baker Planetarium transport viewers to other planets in the solar system in a matter of seconds and reveal the heavens as seen from outer space. It is a part of the Houston Museum of Natural Science, located at the edge of beautiful wooded Hermann Park. Hermann Park is the setting for Houston Zoological Gardens, where there are more than 2,000 animals displayed in modern buildings and outdoor exhibits, and an aviary where more than 200 exotic birds are shown.

Sports abound in Houston and the visitor can find almost any kind of recreation he desires. There are four excellent municipal golf courses. Memorial Park is the site of fine facilities for swimming, riding, and tennis. The Astrodome, the world's first air-conditioned all weather stadium, is the scene of numerous headliner events such as National League baseball, Cougar Football, bullfights, polo, circuses, and many others.

Houston undoubtedly has more air conditioning than any other city in the United States; not only hotels, stores, and office buildings, but also public schools, apartments, homes, and autos are air conditioned.

Send request for further information and/or application form to:

Dr. C. J. Huang, Associate Dean
Cullen College of Engineering
University of Houston
Houston, Texas 77004
Telephone: 713-748-6600, Ext. 408

HOST INSTITUTION

UNIVERSITY OF HOUSTON

HOUSTON, TEX.

HOST INSTITUTION

TEXAS A&M UNIVERSITY

COLLEGE STATION, TEX.

NASA CENTER

MANNED SPACECRAFT CENTER

HOUSTON, TEX.

AERONAUTICS AND SPACE RESEARCH

10 weeks, 9 June–15 August 1969

PROGRAM DESCRIPTION

This will be the fourth year the Summer Faculty Fellowship Program is conducted by University of Houston, Texas A&M University, and NASA Manned Spacecraft Center. The Program provides the Summer Faculty Fellows with the opportunity to participate in research and development activities at the NASA Manned Spacecraft Center and the educational opportunities at the University of Houston. A Faculty Fellow is encouraged to attend the special courses and seminars in the fields related to space exploration, which are given at the University by distinguished scientists and engineers.

For the research and development activities at Manned Spacecraft Center, each Faculty Fellow will be assigned to a senior engineer or scientist at MSC who will act as his research adviser. Each Fellow will be expected to spend full time on a selected research subject at MSC except for the time he attends the lectures and seminars at the University of Houston.

RESEARCH OPPORTUNITIES

The Manned Spacecraft Center is engaged in a strong supporting research and technology program necessary for conducting the initial manned explorations of space and the preparation of unique measuring techniques and apparatus for full appraisal of the space environment compatible with the extensive earth-based data-gathering support systems. The Manned Spacecraft Center programs offer unique opportunities within the varied aspects of space flight. These opportunities lie in the following fields of study.

Science and Applications Research

The Lunar and Earth Sciences Division offers theoretical and experimental research in geology, geochemistry, geophysics, and the *mapping sciences. Specific research programs* are available in the mineralogy, petrology, and chemistry of meteorites, tektites, and volcanic rocks; geochemical and geophysical investigations of terrestrial rocks; field investigations of volcanic and impact craters; and planetary observations including remote geological, geochemical, and geophysical sensing. Research is also available to develop data reduction and interpretation techniques utilizing imagery acquired from space. In addition to geology and geophysics, disciplines covered include geodesy, photometry, and photogrammetry. Experimental and laboratory facilities to support these programs include a well-equipped geochemistry laboratory, geophysics (seismic, IR, photometry) laboratories, the Lunar Receiving Laboratory with its extensive bioscience facilities and the low-level radioactivity counting laboratory. This facility also includes an organic and rare gas mass spectrometry laboratory. A complete mapping sciences laboratory, and a data bank with all Gemini, Ranger, Surveyor, and Lunar Orbiter photography and the associated reduction facilities are also available.

The Space Physics Division has research programs in meteoroid sciences, atmospheric physics, cosmic rays, stellar astronomy, and solar and interplanetary medium physics. Topics of special interest include experimental measurements of meteoroid fluxes and velocities, lunar atmosphere measurements and analysis, aeronomy, M-regions, angular momentum transfer between the sun and the interplanetary medium, solar flare mechanisms, and experiments on high energy ($>10^9$ e v) cosmic rays. Astronomy experiments outside the spectral regions transmitted by the atmosphere are also of interest. In addition to various spaceflight experiments, research facilities include a worldwide network of solar radio and optical (H_α) telescopes, well-equipped optics and electronic laboratories, radiation sources, high and low velocity impact ranges, and vacuum facilities.

Medical Research

Space Medicine and Environmental Physiology. Biomedical scientists at Houston's *Manned Spacecraft are responsible for managing* a broad research program in support of manned space flight. This program is directed toward acquiring definitive data regarding the effects of the space environment on man in order to provide guidance to spacecraft designers and mission planners; defining critical physiological variables to be monitored in order to best assess the functional status of man in the space environment; defining and developing the necessary techniques and instrumentation required for the acquisition of these data; defining those factors of the space flight environment that induce physiological dysfunction in man; recommending procedures for mitigating or eliminating these adverse influences and/or devising countermeasures (preventive or remedial) to neutralize their effects; and defining human requirements for sustenance, optimum habitability, and social-psychological well-being with respect to long duration space missions. This broad, multidisciplinary mandate to acquire new knowledge includes, but is not limited to, the fields of microbiology, biochemistry, hematology and immunology, cardiovascular and pulmonary physiology, neurophysiology, and behavioral psychology.

In the Bioscience Laboratories of the Lunar Receiving Laboratory, a major research effort has been initiated to provide a unique integrated program for the detection and characterization of extraterrestrial life forms that may represent a hazard to a living system within the terrestrial biosphere. The laboratory is also utilized and available for study of the microbiological, virological, and immunological aspects of manned spaceflight.

Engineering and Development

Information Systems. Research is required to develop an on-line computer-aided system for the analysis and design of advanced communications systems, to increase analytical capability in the application of optimization techniques as applied to communication system design, to pursue frequency modulation threshold extension studies, and to investigate limiter-phase detector interactions on signal-to-noise performance.

Engineering effort is required for the development of techniques for computer-enhancing digitized video data applicable to mission control and experiments; prototype systems for manipulating data bases; optical scanning and complementing pattern recognition software to meet unique requirements for manned spaceflight.

Life Support Space Suits and Crew Equipment Systems. Research and development is being conducted on environmental control systems to support longer flight durations. This consists of the concentration and conversion of CO_2 into breathing oxygen and the purification and/or electrolysis of water. In addition, design and analysis of advanced temperature control systems continues. Advanced space suit configurations are being developed and supporting hardware defined such as high-performance portable environmental control systems and extravehicular

aids. Supporting research programs concerned with improved nonmetallic materials for use in the design and development of space suits and crew equipment are conducted. Analytical and prototype design work is conducted on improved food, water, and waste management systems.

Computer Science and Application. Research is required in three categories:

Physics—in conjunction with the development of atmospheric models. Research studies fall into such areas as quantum mechanics, scattering theory, molecular structure theory, and plasma kinetic theory.

Mathematical Analysis—Research studies fall into areas such as approximation theory, numerical analysis, theory of ordinary and partial differential equations, theory of operators, potential theory and its recent developments via Choquet theory, and mathematical statistics.

Optimal Control Theory—Research studies include areas such as system simulations, process identification, specification of optimal criterion functions, dynamic modeling, and statistical control theory.

Facilities available for research studies include sophisticated digital, analog, and hybrid computer systems.

Instrumentation and Electronic Systems Division. Further and continuing research is required to provide optimal data management, recording, and telemetering of spacecraft performance, flight, and experimental data; in simply generated but efficient error correcting codes; in radio frequency communications, tracking, and television systems; in optimal modulation techniques; in spacecraft antennas; in advanced spacecraft microwave radar and tracking systems; in optical frequency communications and tracking techniques.

Guidance and Control. Research continues into theoretical guidance and control systems analysis including theory and techniques for navigation and guidance of manned spacecraft in interplanetary and lunar flight. Steering logic, trajectory analysis, and astrodynamics will be explored. Acceptance criteria for programs written for onboard guidance computers are being developed, as are guidance systems parameters and criteria. These systems include both manual and automatic controls. Laboratory facilities to support simulation studies of these systems are in development. These facilities include both computational and simulator devices, such as cockpit controls.

Spacecraft Propulsion and Power Generation. Research is to be conducted in the areas of main and auxiliary spacecraft propulsion systems, electrical power generation systems including solar, nuclear, and chemical energy sources, and stored energy systems. Basic information, such as requirements, characteristics, criteria, and best methods of use, will be derived from analytical studies conducted on spacecraft systems, main propulsion system components, the reaction control systems, fuel cells, pyrotechnics, gas generators, cryogenic reactants, etc. More specific and continuing research is required in areas such as vacuum ignition, partial combustion effects, and effects of entrained gas in propellants.

Structures and Mechanics Division. Research and analysis are being conducted to define problem areas in spacecraft structures, materials applicability, thermal protection, and thermal control; and to obtain an optimized solution to specific problems within the aforementioned areas. Space simulators, environmental chambers, and completely equipped laboratories in material sciences are available for research and analysis work.

Aerodynamics and Flight Dynamics. Research continues into theoretical and experimental investigation of the stability and control of spacecraft shapes, drag, and heating due to flight in earth and planetary atmospheres. Studies of vehicle dynamics in orbits and during entry into earth and planetary atmospheres are also being conducted. These studies include formulation of mathematical models for use in simulations, determination of control requirements, and investigation of various control techniques.

Advanced Subsystem Requirement Prediction. An area of research has been established to develop gross-level prediction methods for the weights, power requirements, costs, and development leadtimes of advanced subsystems. Research is oriented toward advanced systems analysis and program planning and will enable a rapid assessment of the physical size and development requirements of a spacecraft designed for an advanced mission.

LECTURES AND SEMINARS AT THE UNIVERSITY OF HOUSTON

The following four lecture and seminar series are planned for the Summer Faculty Fellows.

Engineering, Design, and Operation of Manned Spacecraft

History of space flight; mission plan for a space mission; aerodynamic drag and stability; aerodynamic heating; space environment; structural loads; structural concepts and materials; temperature control and heat protection; physiology of space; life support systems; crew station layout; electrical power systems; guidance and navigation problems; automatic stabilization and control systems; onboard propulsion and reaction control systems; solid and liquid rockets; pyrotechnics; electronic systems; launch vehicles and launch vehicle interfaces; design integration; landing systems; mission analysis; mission control systems and network; mission control; recovery; summary of design and operational philosophy.

Advanced Spacecraft Fabrication Technology

Structural criteria; advanced welding technology; power metal shaping; composite and expandable structures; lightweight, self-evacuating insulation system; temperature control coatings; decontamination and sterilization; structural alloys, adhesive bonding and secondary bonding; machining; fabrication of large rocket motor cases; Apollo—design philosophy, material and processes rationale, material and manufacturing; Mercury; Gemini; Saturn; Minuteman; Atlas; Reentry and its thermal problems; thermal protection systems.

Hybrid Computer Application and Simulation in Space Engineering

Review of analog and digital programming concepts—with special emphasis on hybrid requirements, the scope of hybrid computation; system specifications, matching performance criteria with area of application; analog-to-digital and digital-to-analog interfacing; simple applications of hybrid computers, patchable logic and iterative computation; error analysis techniques, sampling errors, static and dynamic errors; design and use of hybrid software; executive routines, recursive routines; trap processing; digital simulation software; simulation of sampled data systems and random processes; numerical integration by hybrid techniques; maintenance, diagnostic, and other programming aids; optimization theory and applications to multiparameter systems, trajectory optimization, guidance and control, mission design and analysis; partial differential equations; error compensation methods; management of hybrid facilities.

Advanced Seminars in Space Engineering and Science

Special seminars on the topics related to advanced space science will be given by distinguished scientists and engineers. For example, the speakers for the 1967 Summer Faculty Fellowship Program included Nobel Laureates Libby and Urey, Congressman Casey, and Astronaut-scientist Harrison Schmitt.

GENERAL INFORMATION

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Send request for additional information and/or completed application form to:

Dr. C. J. Huang
Associate Dean
Cullen College of Engineerings
University of Houston
Houston, Texas 77004
Telephone: 713-748-6600, Ext. 408

Application Form

1969 NASA-ASEE SUMMER FACULTY FELLOWSHIP PROGRAMS

AERONAUTICS & SPACE RESEARCH — ENGINEERING SYSTEMS DESIGN

Name of Applicant _____
(Last) (First) (Middle)

Present Position _____
(Title) (Institution and Department)

Business Address _____ **Phone** _____

Home Address _____ **Phone** _____

Place of Birth _____ **Date of Birth** _____ **Citizenship** _____

Marital Status _____ **Number of Children** _____

Social Security No. _____ **1968-69 9-Month Academic Salary** _____

Housing Desired: City _____ **Suburban** _____ **No. of Bedrooms** _____ **Approx. Rental** _____

Highest Academic Degree, Field, and Year _____

If you do not hold a doctorate, are you working toward that degree? _____

Date expected _____ Institution and Department _____

Special Field of Knowledge _____

_____

Field of Present Research Activity _____

_____

Field of Present Design Activity _____

_____

If Present Research or Design Activity is supported, give sponsor _____

Anticipated Research and/or Design Interests _____

_____

Field(s) of Present Teaching Activity _____

_____

LETTERS OF RECOMMENDATION

Please request your Department Head or Dean to send a letter of recommendation directly to the Institutes to which you are applying. This letter should indicate to what extent your institution would benefit from your participation in this program. Also, give the names and addresses of two other people to whom we may write:

1. Dean or Department Head _____

2. _____

3. _____

(OVER)

SUPPLEMENTARY INFORMATION

On a separate sheet please give the following supplementary information:

1. Colleges attended, with dates of attendance and degrees received, area, and titles of theses and dissertations.
2. Chronology of professional employment and significant academic and professional activities.
3. List of publications.
4. Design experience.
5. Courses taught, including textbooks or reference books used.
6. Any other information you feel may be helpful.
7. Past participation in NASA-ASEE Summer Faculty Fellowship Programs.

INSTITUTES

The Institutes are listed below. You may apply for more than one institute, however, it is important that you indicate your order of preference by noting the figures 1, 2, and 3 in the appropriate box. **Submit the original documents to the Institute of first choice with copies to any other Institute to which you are applying, and send material to persons listed below.**

ENGINEERING SYSTEMS DESIGN INSTITUTES

☐ **University of Houston and Rice University—NASA Manned Spacecraft Center**
Dr. C. J. Huang, Associate Dean, Cullen College of Engineering, University of Houston, Houston, Texas 77004. Telephone: 713-748-6600, Ext. 408

☐ **Auburn University and University of Alabama—NASA Marshall Space Flight Center**
Dr. R. I. Vachon, Alumni Professor, Mechanical Engineering, Auburn University, Auburn, Alabama 36830. Telephone: 205-826-4574

☐ **Stanford University—NASA Ames Research Center**
Mrs. Jane Fajardo, Administrative Aide, Department of Aeronautics and Astronautics, Stanford University, Stanford, California 94305. Telephone: 415-321-2300, Ext. 3079

☐ **Old Dominion College—NASA Langley Research Center**
Dr. G. L. Goglia, Professor and Chairman, Thermal Engineering Department, Old Dominion College, Norfolk, Virginia 23508. Telephone: 703-637-2931, Ext. 322

AERONAUTICS & SPACE RESEARCH INSTITUTES

☐ **Stanford University—NASA Ames Research Center**
Mrs. Jane Fajardo, Administrative Aide, Department of Aeronautics and Astronautics, Stanford University, Stanford, California 94350. Telephone: 415-321-2300, Ext. 3079

☐ **Case Western Reserve University—NASA Lewis Research Center**
Dr. Frederic A. Lyman, Associate Professor, School of Engineering, Case Western Reserve University, Cleveland, Ohio 44106. Telephone: 216-368-4580

☐ **The Catholic University of America and University of Maryland—NASA Goddard Space Flight Center**
Dr. Bertrand T. Fang, Department of Space Science and Applied Physics, The Catholic University of America, Washington, D. C. 20017. Telephone: 202-529-6000, Ext. 571

☐ **Old Dominion College—NASA Langley Research Center**
Dr. G. L. Goglia, Professor and Chairman, Thermal Engineering Department, Old Dominion College, Norfolk, Virginia 23508. Telephone: 703-637-2931, Ext. 322

☐ **University of Houston and Texas A&M University—NASA Manned Spacecraft Center**
Dr. C. J. Huang, Associate Dean, Cullen College of Engineering, University of Houston, Texas 77004. Telephone: 713-748-6600, Ext. 408

☐ **University of Alabama and Auburn University—NASA Marshall Space Flight Center**
Dr. B. F. Barfield, Associate Professor and Director, Thermal/Fluid Sciences Division, Department of Mechanical Systems Engineering, University of Alabama, Box 6307, University, Alabama 35486. Telephone: 205-348-6311

☐ **California Institute of Technology—NASA Jet Propulsion Laboratory**
Dr. Hadley W. Ford, University Relations Office, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, California 91103. Telephone: 213-354-3274

☐ **Northeastern University—NASA Electronics Research Center**
Professor C. G. Houtsma, Northeastern University, 360 Huntington Avenue, Boston, Massachusetts 02115. Telephone: 617-427-1337

Would you be willing to commit yourself to continue the research program during the summer of 1970? ☐ **Yes** ☐ **No**

Date_____ **Signature**_____

DEADLINE FOR RECEIPT OF APPLICATION AND ALL SUPPORTING MATERIAL: FEBRUARY 15, 1969

Fellows will be notified approximately March 15, 1969

Summer Faculty Fellowships

For U.S. citizens who are faculty or research staff members, preferably with two years of teaching experience.

NASA National Aeronautics & Space Administration **&** **ASEE** American Society for Engineering Education

ENGINEERING SYSTEMS DESIGN

OBJECTIVES: (1) To increase competence and to develop concepts which will enable participants to organize multidisciplinary engineering systems design programs and courses at their home institutions. (2) To establish and further communication and collaboration between engineering and other disciplines.

DESIGN FELLOWSHIPS: Awarded to young engineering and science faculty members in programs of summer study to be undertaken by several universities in cooperation with NASA research centers. Fellows will come to universities adjacent to NASA centers to participate as members of multidisciplinary design teams. Each group will select and design a complex space system, such as an unmanned planetary reconnaissance vehicle, a manned spacecraft, or an applications satellite system. The Fellows will be associated directly with the space program and will be confronted with the most modern systems design problems. The engineering systems concept, that of approaching the design problem in its entirety, will be utilized by the faculty design teams.

FELLOWSHIPS: Stipends are intended to meet the salary of the participant but will not exceed $275 per week. Travel allowance will be paid. Approximately 80 Fellowships will be awarded. Several faculty members from a single university are encouraged to participate as a part of a design team.

DURATION: 11 weeks.

PROGRAM DESCRIPTIONS

Manned Spacecraft Center — **University of Houston, Rice University**
June 9—August 22, 1969
Design of all facets of a manned exploration vehicle.

Marshall Space Flight Center — **Auburn University, University of Alabama**
June 9—August 22, 1969
System design of an earth-orbiting research laboratory.

Ames Research Center — **Stanford University**
June 16—August 29, 1969
Preliminary design and feasibility study of a commuter airplane system which can compete economically with high-speed surface or subsurface transportation systems.

Langley Research Center — **Old Dominion College**
June 9—August 22, 1969
Preliminary design of an earth resources satellite system.

AERONAUTICS AND SPACE RESEARCH

OBJECTIVES: (1) To further the professional knowledge of qualified engineering and science faculty members. (2) To stimulate an exchange of ideas between participants and NASA. (3) To enrich and refresh the research and teaching activities of participants' institutions.

RESEARCH FELLOWSHIPS: Awarded to young engineering and science faculty members for summer research in a NASA-university cooperative program. Fellows will conduct research projects of mutual interest to the Fellow and to the NASA center. Each Fellow will work with a center colleague and will be associated directly with the aeronautics and space program and the concomitant basic research problems. Special courses, seminars, workshops, lectures and the like are included in each cooperative program. These Fellowships may be renewed for a second summer.

FELLOWSHIPS: Stipends are intended to meet the salary of the participant but will not exceed $250 per week for first-year Fellows or $275 per week for second-year Fellows. Travel allowance will be paid. Approximately 150 first-year Fellowships will be awarded.

DURATION: 10 weeks.

PROGRAM DESCRIPTIONS

Ames Research Center — **Stanford University**
June 23—August 29, 1969
Research in space physics, fluid and gas dynamics, guidance and control, systems engineering, structural dynamics, materials, biomedical engineering, and life sciences.

Goddard Space Flight Center — **Catholic University of America, University of Maryland**
June 16—August 22, 1969
Research in data acquisition and reduction, space and plasma physics, communications and telemetry, and quantum electronics.

Lewis Research Center — **Case Western Reserve University**
June 9—August 15, 1969
Research in aerospace engineering, physics, chemistry, and materials, as broadly related to propulsion and power generation.

Langley Research Center — **Old Dominion College**
June 9—August 15, 1969
Broad research related to manned and unmanned space exploration and improvement in performance, safety, and utility of airborne flight.

Manned Spacecraft Center — **University of Houston, Texas A&M University**
June 9—August 15, 1969
Research and technology in space environment, systems evaluation and development, crew systems, space technology, space science, and engineering design.

Marshall Space Flight Center — **University of Alabama, Auburn University**
June 9—August 15, 1969
Research in aero-astrodynamics, astrionics, computation, propulsion and vehicle engineering and associated basic and applied fields.

Jet Propulsion Laboratory — **California Institute of Technology**
June 23—August 29, 1969
Research in space science, guidance and control, spacecraft power, telecommunications, systems engineering, engineering mechanics, propulsion, and environmental engineering, with seminars on spacecraft technology.

Electronics Research Center — **Northeastern University**
June 16—August 22, 1969
Research in electric components, guidance and control, instrumentation, electromagnetics and associated basic science fields.

For application forms and information, please contact:
Mr. Leslie B. Williams, American Society for Engineering Education
2100 Pennsylvania Ave., N.W., Suite 838
Washington, D. C. 20037 Phone: 202-659-2862

APPLICATION DEADLINE: February 15
ANNOUNCEMENT OF AWARDS: March 15

1969